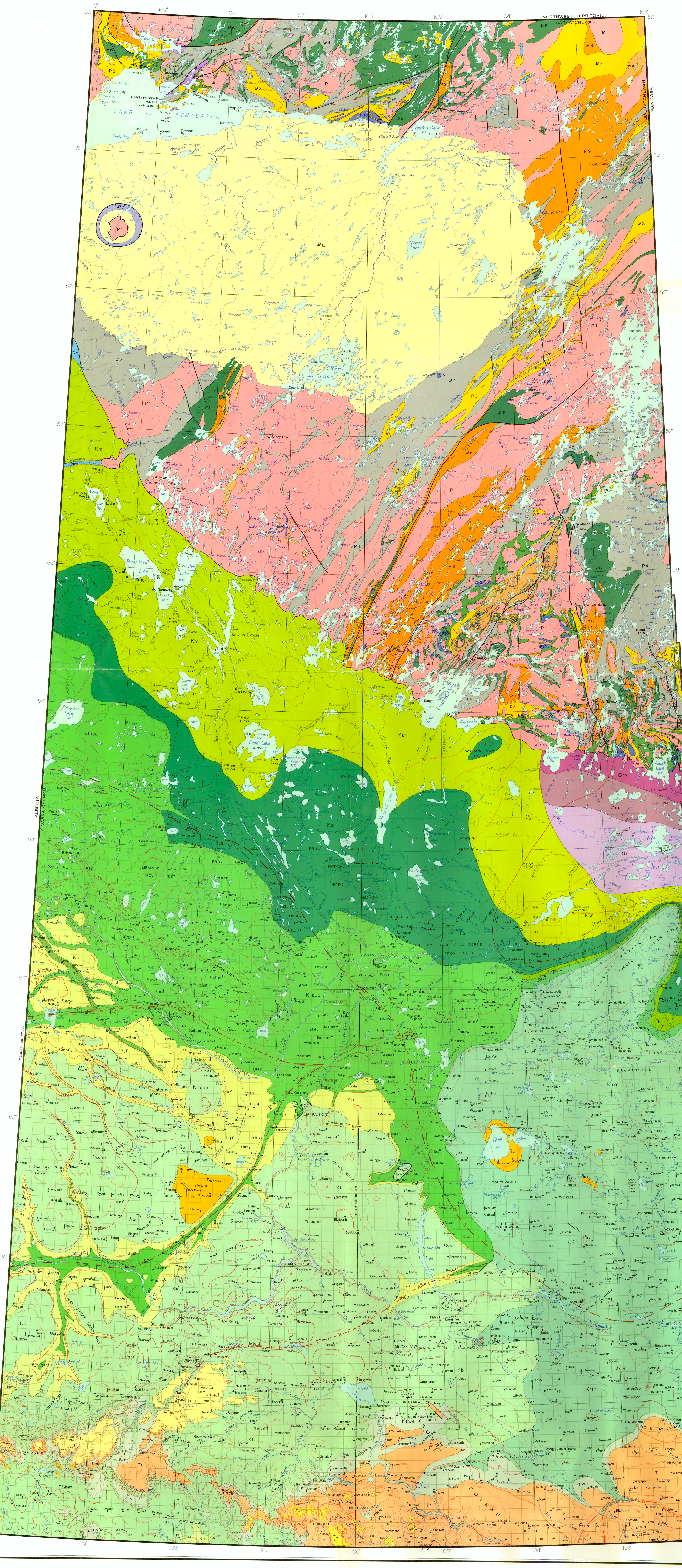
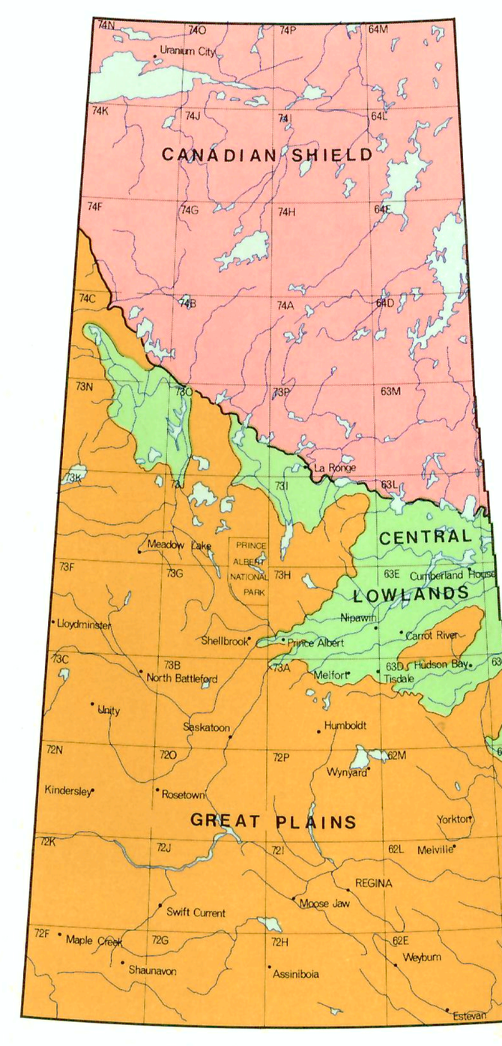
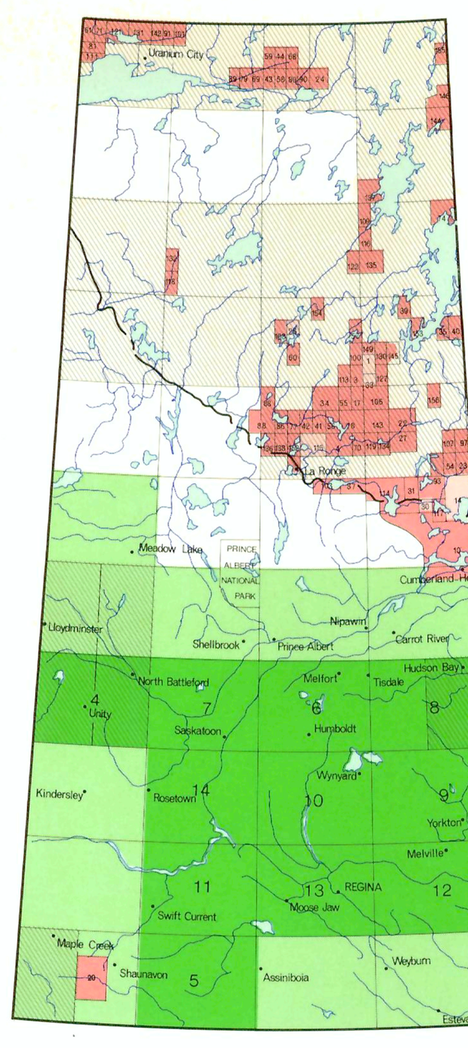
PROVINCE OF SASKATCHEWAN
DEPARTMENT OF MINERAL RESOURCES
Geological Sciences Branch
and
SASKATCHEWAN RESEARCH COUNCIL
Geology Division





PHYSIOGRAPHIC MAP



GEOLOGICAL MAP COVERAGE

- Geological Survey of Canada: maps and reports 1" = 4 mile (1:253,440); more detailed around Flin Flon and Uranium City
- Department of Mineral Resources: published report 1" = 1 mile (1:63,360); published report 1" = 1/2 mile (1:31,680)
- Saskatchewan Research Council: published maps 1" = 4 mile (1:250,000); in preparation

DESCRIPTIVE NOTES

General

Saskatchewan includes three major physiographic provinces that are closely related to the underlying geology — the Canadian Shield, the Central Lowlands, and the Great Plains. The Canadian Shield coincides with the occurrence of rocks of Precambrian age in northern Saskatchewan. The Central Lowlands and Great Plains coincide with the occurrence of flat-lying to very gently dipping sedimentary rocks of Paleozoic, Mesozoic, and Tertiary age in southern Saskatchewan. In the Central Lowlands of central and southeastern Saskatchewan, glacial and glacio-fluvial erosion primarily determine the shape of the bedrock surface, whereas in the Great Plains of southwestern Saskatchewan preglacial fluvial erosion primarily determines the shape of the bedrock surface with lesser modification by glacial and glacio-fluvial erosion.

Precambrian

The Precambrian rocks of northern Saskatchewan may be divided into two groups; the metamorphosed, complexly deformed and locally migmatised crystalline basement of Lower Proterozoic and Archean age, and the relatively undeformed, unmetamorphosed sedimentary cover of Helikian age. A pronounced unconformity separates the two groups.

The youngest cover rocks, intensely folded marine stromatolitic dolomites of the Carswell Formation, form the rim syncline of the diapiric Carswell circular structure. The undeformed Athabasca Formation, composed predominantly of fluviatile sandstones, underlies the Carswell Formation, but is probably younger than the red-bed continental deposits and associated volcanic rocks of the Martin Formation, which are exposed in the Beaverlodge area, north of Lake Athabasca.

Within the basement, geological and radiometric evidence suggests that both Lower Proterozoic and Archean rocks are preserved, but in most areas age relationships are obscure. For this reason, no attempt at a stratigraphic sub-division is made in the accompanying explanation.

Highly deformed Aphebian metasedimentary rocks define a pronounced northeasterly trending structure from Pinehouse Lake to Wollaston Lake and beyond to the Manitoba border. This is the Wollaston Lake Fold Belt, composed predominantly of biotite gneisses, meta-arkoses, and locally, marble, calc-silicates and hornblende gneisses, all of which apparently lie unconformably above deformed granite gneisses of Lower Proterozoic or Archean age.

At the south end of this fold belt, both granitic gneisses, in part of Archean age, and the supracrustals, plunge northeasterly, possibly exposing progressively higher structural levels to the northeast. To the west, a predominantly granitic basement, probably of Archean age, and largely unexplored geologically, extends westward to the narrow supracrustal wedge of the Virgin River gneiss belt. An extensive granite and migmatite basement separates the southern part of the Wollaston Lake Fold Belt from the La Ronge-Reindeer Lake Belt, a northeast-trending sequence of metavolcanic and metasedimentary gneisses, which is probably contiguous with the Wasekwan and Sickle series of the Lynn Lake area. The age of a similar series of meta-arkoses and metavolcanics lying between the Tabbernor fault system and this belt is unknown.

North and west of Flin Flon, the predominantly volcanic Amisk Series is unconformably overlain by fluviatile sandstones of the Missi series. These rocks, which are considered by some to be of Aphebian age, have been intimately intruded by large granodiorite plutons. By way of contrast, similar metavolcanic rocks at Hanson Lake may be of Archean age.

To the north of the Amisk greenstones, complexly refolded granodiorite plutons define a classic fold interference pattern within biotite- and amphibole-bearing Kisseynew gneisses. East of Pelican Narrows, the Amisk greenstones apparently grade imperceptibly into amphibole-bearing gneisses. These strike northwesterly, and are probably contiguous with the amphibole gneisses of the Scimitar Lake area. Thus the northward continuation of the Amisk volcanics is probably those amphibole-bearing gneisses exposed a little south of Deep Bay on Reindeer Lake.

North of Lake Athabasca, migmatites, granitic intrusives, and metasedimentary and metavolcanic rocks of the Tazin Group form a basement complex. These rocks are intensely folded and, in places, are cut by numerous shear zones, mylonite zones, and faults which define linear deformation belts.

Both Archean and Lower Proterozoic sequences may be represented in the basement, but generally there are no field criteria for distinguishing them. An exception to this is near Thluicho Lake, west of Uranium City, where lower grade phyllites and greywackes of the "Lower Athabasca Series" unconformably overlie, and are deformed with, the crystalline basement rocks. This may represent the unconformity between Archean and Aphebian rocks, although the "Lower Athabasca Series" is regarded by some as Paleohelikian.

East of Fond du Lac, large mafic garnetiferous "foliated norites" define an arcuate structure, flanked to the north by biotite gneisses and amphibole-bearing gneisses, all apparently within a further linear deformation belt.

The age relationship between Hurwitz-like mixed metasediments, exposed along the common boundary with the Northwest Territories and Manitoba, and Aphebian metasediments of the Wollaston Lake Fold Belt, remains enigmatic.

Paleozoic

Paleozoic rocks are exposed only in the Cumberland Lowland and the Clearwater River valley. Little is known about these areas because there are few outcrops and very little subsurface information. Silurian and Ordovician dolomite, dolomitic limestone and Ordovician sand crop out in the Cumberland Lowland, whereas Devonian dolomite crops out in the Clearwater River valley. Along the Precambrian Shield north of the Wapawekka Hills there may be some occurrences of Cambro-Ordovician sand, but these are included with similar quartzose sand of the Swan River Group. Isolated carbonate outcrops on the Shield suggest that Paleozoic rocks had a greater extent to the northeast prior to Pleistocene glaciation.

Mesozoic

Marine and nonmarine sands and silt or clay-shales of Cretaceous age occur at the bedrock surface over most of southern Saskatchewan. These rocks represent alternating periods of predominantly nonmarine (Swan River Group, Judith River, Whitemud, and Frenchman Formations) and marine (Ashville Group through Lea Park Formation and Bearpaw and Eastend Formations) deposition corresponding to alternating regressions and transgressions of the Cretaceous sea of the Western Interior of North America.

The boundary between the Lea Park Formation and Upper Colorado Group to the west and the Riding Mountain, Vermilion River and Favel Formations to the east is determined south of the Quill Lakes by the pinchout of the Judith River Formation and north of the Quill Lakes by the area beyond which the upper contacts of the Vermilion River and Favel Formations become difficult to recognize on geophysical logs.

Tertiary

Two types of Tertiary nonmarine sediments occur in Saskatchewan. The lignite-bearing, alluvial-plain sediments of the Ravenscrag Formation occur as a band across southern Saskatchewan extending southward into the United States. Alluvial sand and gravel deposits are preserved as erosional remnants capping uplands across southern Saskatchewan (Cypress Hills and Wood Mountain Formations), and as isolated outliers beneath thick glacial deposits in the Rosetown and Quill Lake localities (Undifferentiated Tertiary).

Bedrock Topography

The bedrock throughout most of southern Saskatchewan is buried beneath thick glacial sediments. The shape of the bedrock surface, as indicated by the red contours of the map, is attributed to three main processes; fluvial erosion, glacial erosion and normal faulting. Southwest of the Hatfield Valley the predominant process was fluvial erosion by preglacial streams such as those that cut the Tyner and Battleford Valleys or by glacial meltwater streams such as those that cut the many narrow valleys that trend southeast, including portions of the present Qu'Appelle Valley. However, glacial erosion extensively modified the Missouri Coteau. Northeast of the Hatfield Valley the predominant process was glacial erosion which produced the major lowlands of eastern Saskatchewan (Montreal Lake, Prince Albert-Cumberland, Hudson Bay, and Red Deer). Throughout central and southeastern Saskatchewan, the many closed depressions of the map resulted from downfaulting of strata overlying areas where the Devonian Prairie Evaporite has been removed by groundwater solution.

Sources

In the Precambrian area, the geological maps and reports of the Saskatchewan Department of Mineral Resources and the Geological Survey of Canada, together with aeromagnetic maps of 1" to 1 mile scale and assessment work submitted to the Department of Mineral Resources, formed the basis of the geological compilation. In the sedimentary area of southern Saskatchewan the geology and groundwater resources maps of the Saskatchewan Research Council were the basis for the geological compilation.

EXPLANATION

CENOZOIC

Tertiary

- **Tu** — **Undifferentiated** (specific age unknown): quartzite and chert gravel, interbedded with sand, silt, and clay; locally a conglomerate with carbonate cement

MIOCENE

- **Twm** — **Wood Mountain Formation**: quartzite and chert gravel, interbedded with sand, silt, and clay; locally a conglomerate with carbonate cement

OLIGOCENE-EOCENE

- **Tch** — **Cypress Hills Formation**: quartzite and chert gravel, interbedded with sand, silt, and clay; locally a conglomerate with carbonate cement

PALEOCENE

- **Tr** — **Ravenscrag Formation**: interbedded sand, silt, clay, and lignite; local carbonaceous zones, kaolinitic zones, concretionary zones, and calcareous zones

MESOZOIC

Cretaceous

- **Kfwe** — **Frenchman Formation**: interbedded sand, silt, and clay; local bentonitic zones, carbonaceous zones, and calcareous zones. **Whitemud Formation**: upper portion — plastic kaolinitic clay and sand, includes Battle Clay; middle portion — carbonaceous, silty clay; lower portion — partially kaolinized sand and silt. **Eastend Formation**: fine-grained sand and silt; locally carbonaceous in upper portion; sand commonly calcareous
- **Kb** — **Bearpaw Formation**: noncalcareous, silty clay-shale, locally bentonitic and concretionary; includes several sand members
- **Kjr** — **Judith River Formation**: interbedded sand, silt, and clay-shale; commonly carbonaceous and noncalcareous; local bentonitic zones and thin coal beds
- **Klpuc** — **Lea Park Formation and Upper Colorado Group**: gray, silty clay-shale, upper part noncalcareous; includes calcareous "First and Second White-Speckled Shale" beds at base
- **Krmo / Krm** — **Riding Mountain Formation**: gray, noncalcareous silty clay, concretionary zones common near base; includes Odanah Member, a siliceous shale
- **Kvr** — **Vermilion River Formation**: dark gray calcareous silt and clay, grading downward into locally petroliferous, slightly calcareous to noncalcareous silt and clay
- **Kf** — **Favel Formation**: dark gray, calcareous shale containing thin beds of clayey limestone.
- **Ka–Klc** — **Ashville — Lower Colorado Group**: gray, noncalcareous clayey silt and silty clay; fine glauconitic sand at base; includes "Fish Scales" marker bed and Viking Formation
- **Ksr–Km** — **Swan River — Mannville Group**: interbedded fine to coarse sand, silt, and clay; local cemented zones, carbonaceous zones, and thin coal beds

PALEOZOIC

Devonian

- **Dm** — **Methy Formation**: limestone and dolomite

Silurian

- **Si** — **Interlake Formation**: dolomite, minor thin sandy argillaceous beds

Ordovician

- **Oss** — **Stonewall Formation**: dolomite and limestone. **Stony Mountain Formation**: dolomite, limestone, and shale
- **Orw** — **Red River Formation**: dolomite and limestone. **Winnipeg Formation**: sand

PRECAMBRIAN

SEDIMENTARY COVER

- **₽c** — **Carswell Formation**: dolomite
- **₽a** — **Athabasca Formation**: predominantly fluviatile sandstone with minor shale and conglomerate
- **₽m** — **Martin Formation**: arkose, sandstone, siltstone, conglomerate with basalt flows near Martin Lake

Pronounced Unconformity

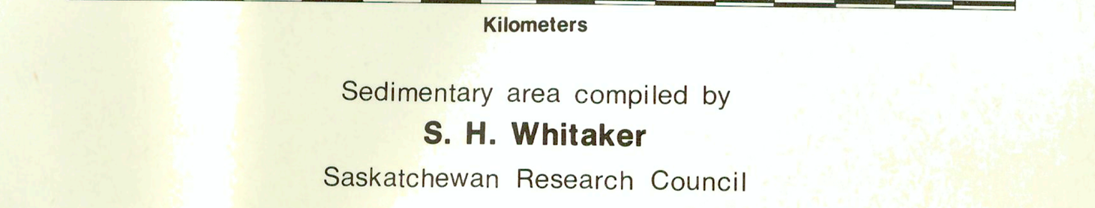
Beneath this unconformity no stratigraphic order is implied by the sequence of the explanation.

BASEMENT COMPLEX

- **₽10** — **Mafic and ultramafic rocks;** includes gabbro, pyroxenite, diorite, quartz diorite and basalt
- **₽9** — **Migmatite and mylonite zones;** complexes of mixed metasediment and granite
- **₽8** — **Marble and calc-silicate gneisses**
- **₽7** — **Conglomerate**
- **₽6** — **Amphibolite and hornblende-bearing gneisses;** in part may be volcanic, intrusive or sedimentary in origin, contains hypersthene-bearing amphibolite gneisses west of Virgin River
- **₽5** — **Mixed metasediments;** undifferentiated schists and gneisses of pelitic, semi-pelitic and psammitic composition
- **₽4** — **Pelitic schists and gneisses;** essentially aluminous metasediments including cordierite-, sillimanite-, staurolite-, and garnet-bearing biotite gneisses (many rocks mapped as "biotite gneisses" are psammitic); north of Lake Athabasca grade into migmatites
- **₽3** — **Psammites; essentially meta-arkose, quartzite and micaceous psammites**
- **₽2** — **Metavolcanic rocks and meta-greywackes;** includes basalt, andesite, rhyolite, volcanic breccia, tuff, agglomerate, subordinate meta-greywacke, chlorite schist and hornblende schist
- **₽1** — **Granite, granodiorite, quartz monzonites;** may be massive or gneissic, includes areas in which metasediments may be intimately mixed

Contour lines on bedrock surface (contour interval 200 feet)
Trend of bedrock valley
Geological contact
Fault
Boundary between laterally equivalent lithostratigraphic units

Scale: one inch equals 20 miles or 1:1,267,200



Sedimentary area compiled by
S. H. Whitaker
Saskatchewan Research Council

Precambrian area compiled by
D. E. Pearson
Department of Mineral Resources

Cartography and drafting by C. G. Elias and J. C. Sardinha, Saskatchewan Research Council

Base map modified from map supplied by Department of Energy, Mines and Resources, Ottawa
Photographic preparation by General Graphic Services Ltd., Saskatoon
Typesetting by Midwest Litho, Saskatoon
Printed by York Litho Limited, Toronto

1972

GEOLOGICAL MAP OF SASKATCHEWAN