FORT BELKNAP RESERVATION

List of Topics

OVERVIEW

FORT BELKNAP RESERVATION

Assiniboine and Gros Ventre Tribes

TRIBAL HEADQUARTERS: Fort Belknap Agency, Montana
GEOLOGIC SETTING: Williston Basin

Location and Access

The Fort Belknap Reservation is located in southeast Blaine and western Phillips Counties of north-central Montana. The reservation lands are situated 45 miles east of Harve on State Highways 87 and 191 east of Great Falls. Tribal headquarters are located at the Fort Belknap Agency, four miles east of Harlem. The Bureau of Indian Affairs Area Office is located in Billings.

Topography

Most of the reservation is located on the northern Great Plains. The southeastern portion, however, is located on the flanks of the Little Rocky Mountains. Most of the available acreage is located on the flat, easily accessible plains. Three prominent buttes dominate the western side. These are Twin Buttes, Wild Horse Butte and Snake Butte. Elevations within the reservation range from 2,300 ft. to 5,000 ft. Principal rivers are the Milk River, which forms the northern reservation boundary, White Bear Creek, in the northwestern corner, and the east-flowing South Fork of Peoples Creek, which roughly divides the reservation in half.

Land Ownership

The Fort Belknap Reservation consists of 980 square miles or approximately 627,000 acres, of which, the tribes have mineral interest (BIA Trust Estate) in about 61,000 acres. In addition to the reservation lands, the tribes at Fort Belknap hold mineral interest in 25,5000 acres immediately west of the reservation, referred to as submarginal lands. Approximately 21,000 mineral acres within the boundary of the reservation are under patented-in-fee or state ownership. About 2,000 tribal mineral acres are withdrawn from development activities due to religious significance and 26,800 tribal mineral acres are in the timber reserve. The latter acreage are in the Little Rockies and probably are not of oil and gas interest since Paleozoic rocks outcrop. Available tribal minerals for an oil and gas agreement amount to about 58,000 acres. The Tribal Community Council with BIA concurrence could authorize an agreement for this entire acreage or portions thereof.

Individual Indians (Allottees) have a mineral interest in approximately 535,000 acres although their surface interest is about 400,000 acres. The 1982 Indian Mineral Development Act would allow allottees to joint a Tribal Agreement (25 U.S.C. Sec. 210(b)) which equates to possibly upwards of 600,000 available acres.

Allottees normally must have their parcels individually offered in an administered lease sale prior to entering direct negotiations with a company. Therefore this proposal offers a unique opportunity for interested companies and mineral owners alike. The conditions of allottee joinders to a Tribal Agreement will be discussed further in the section entitled Tribal Government and Operating Regulations.

Historical Background of the Assiniboine and Gros Ventre Tribes at Fort Belknap

The Fort Belknap Indian Reservation was created in 1887 as the home for the Assiniboine and Gros Ventre Indian Tribes. The ancestors of these tribes have lived on the northern plains for several centuries. The Assiniboine were recognized by Europeans as part of the great Sioux Nation and speak a Siouan language. However, their name is taken from a Chippewa word referring to "those who cook with stones." At some point in time the Assiniboine bands broke with the traditional Sioux and allied themselves with the Cree. The tribe settled along the Milk River and hunted between the Yellowstone River and southern Canada. The Assiniboines quickly adopted horses, firearms and a reliance on commerce, thus completing their transition from an agrarian / woodlands to a hunting/trading economic system.

The Gros Ventre separated from the Arapaho and may be some of the original inhabitants of the western plains. French Canadian fur trappers gave the tribe their name, which translates to "big bellies", based on the tribal name in the Blackfeet and Shoshone languages. The Gros Ventre used the Blackfeet language in trade and were therefore considered part of the Blackfeet Nation. This association resulted in the inclusion of the Gros Ventre in the Blackfeet Treaty signed in 1855 with Governor Stevens of the Washington Territory. Because of intertribal hostilities the Gros Ventre relocated near the Little Rocky Mountains. Although the federal government opened this new area, the Gros Ventre remained between the Milk River and the Little Rocky Mountains. As indicated above, in 1887 the Gros Ventre were included with the Assiniboine in a treaty establishing the Fort Belknap Indian Reservation.

Competitive Negotiations for Mineral Agreements

The Assiniboine and Gros Ventre Tribes of the Fort Belknap Reservation are sincerely interested in working with energy companies and individuals towards the development of the oil and gas resources underlying the reservations. The acquisition of good oil or gas prospects through leasing or other agreements, the diligent exploration of prospects generated, and the ultimate production from the wells drilled are three compatible goals for all the parties. The Tribes may be amenable to a variety of arrangements to see that these goals are reached, and feel that competitive solicitations leading to negotiated contracts offers the maximum flexibility to all parties concerned.

Authority to Negotiate Oil and Gas Agreements

The lands described in this Atlas are held in trust by the Bureau of Indian Affairs. Therefore, oil and gas leases must be consummated pursuant to federal regulations. Authority to lease Indian trust lands through a negotiated agreement is provided in the Indian Minerals Development Act of 1982 (P.L. 97-382). However, final regulation implementing the 1982 Act have not been promulgated at this writing. The regulations governing the leasing of Indian lands under the 1938 Mineral Leasing Act can be found in the Code of Federal Regulation, Title 25, Part 211 for tribal lands. The July 12, 1984 edition of the Federal Register has proposed regulations for 25 CFR, Part 225 *Oil and Gas Mineral Contracts* to encompass the 1982 Indian Mineral Development Act.

Since the enactment of the Indian Mineral Development Act of 1982, tribes have been afforded the opportunity to directly negotiate leases or other contracts (i.e. joint ventures) in contrast to procedures and regulatory minimums imposed by the previous 1938 Minerals Leasing Act. The 1982 Act further provides that individual Indian allottees may join agreements negotiated for tribal lands. The section entitled Operating Regulations discusses the procedures for obtaining allottee participance in the negotiated agreement.

Principal components for the formal corporate proposal should include the area(s) of interest, type of contract, elaboration of proposed agreement terms, points of potential negotiation, diligence commitments (i.e. drilling), bonus considerations, acreage relinquishments, tribal employment of training, etc. Also an interested company or individual should provide evidence of experience and ability to meet financial or diligence commitments.

Joinder Agreement For Individual Indians

Pursuant to the 1982 Indian Minerals Development Act, Indian allottees may join a tribal negotiated agreement. The Fort Belknap Community Council plan to solicit allottee interest once negotiations are underway to minimize company curative land acquisition.

The BIA Area Office in Billings is currently developing an administrative process to streamline this effort and yet protect their trustee interest. A joinder agreement was reviewed by the BIA Solicitor's Office in 1984. At that time the Solicitor concluded "-- we see no reason why this agreement would not comply with all legal requirements." The 1982 Act provides for two legal requirements for allottees to join a tribal mineral agreement:

(1) all parties must consent
(2) the Secretary must find that it is in the best interest of the individual to participate

The Secretary must evaluate within 180 days to approve or disapprove the terms of any agreement regardless of allottee participation.

Requirement for Environmental Assessment

A negotiated contract pursuant to the Indian Mineral Development Act will require an Environmental Assessment (EA) for the area under consideration for oil and gas exploration and development activities. Generally the BIA requires the company to prepare this documentation which can equate to delays in the final review and approval process of the negotiated contract. Numerous previous investigations exist that relate to the needed components of the EA. The tribes and CERT are in the process of assembling these reference studies for use by the company and the BIA. Additionally, the tribes have requested that BIA initiate or fund the duration of this study to expedite the final approval process. For the initial submittal, the company need not concern themselves with the baseline data acquisition but should give the tribe some idea about a plan of operations and precautions that will be taken to insure environmental protection and mitigation of damages to flora, fauna, air, water and property.

Operational Regulations

Tribal Government

Fort Belknap Indian Reservation, the home of the Gros Ventre and Assiniboine Tribes was created by treaty on October 17, 1885 and by an Act of Congress on May 1, 1888. The business and governmental affairs of Fort Belknap are conducted under the authority of a constitution and bylaws ratified by members of the Tribes on October 19, 1935, and approved by the Secretary of the Interior on December 13, 1935, pursuant to the Indian Reorganization Act of 1934. Subsequently, a corporate charter for the Fort Belknap Indian Community was ratified by members of the Community on August 25, 1937.

The principal decision-making body for the Reservation is the Fort Belknap Community Council, consisting of six Assiniboine and six Gros Ventre members. Each council member serves for a four year term. Every two years, each of the three voting districts--Milk River and Lodge Pole elect an Assiniboine and a Gros Ventre memeber to the Council. On the first Monday in January following each election, a president, vice-president and secretary/treasurer are elected from within the twelve council members. Council officers serve for a period of two years. The current officers were elected January 1984. Any council memeber or officer may serve as long as he/she is re-elected to office.

The Tribal President appoints standing committees which meet monthly as needed. Negotiation for an oil and gas agreement would be conducted by the Tribal Community Committee. Any oil and gas development agreement would have to receive final approval from the Tribal Council.

CONTACT

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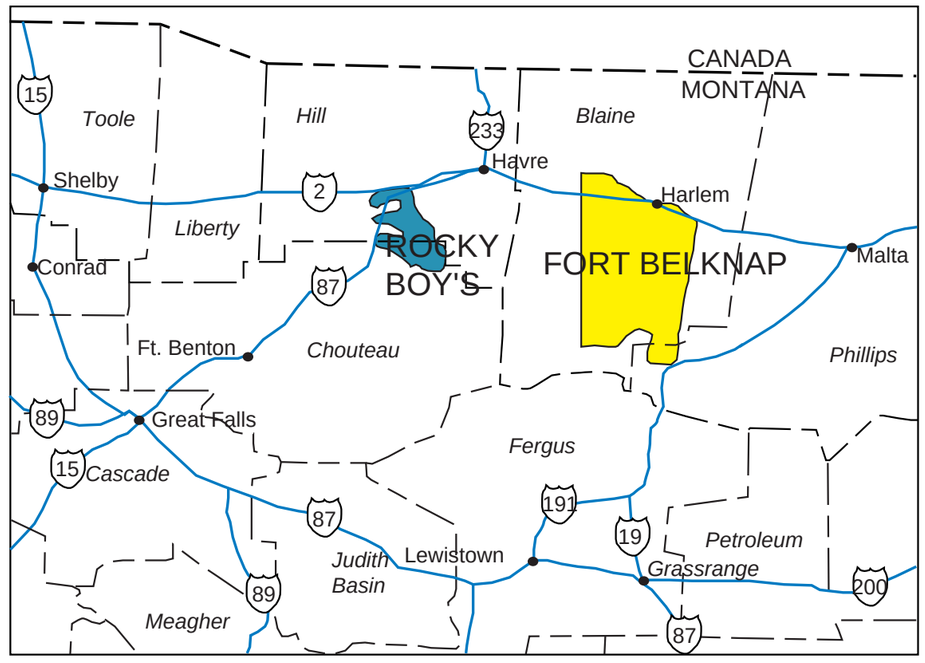
Operating Regulations

The reservation lands available for oil and gas leasing or other types of mineral agreements are largely allotted lands (86.5%) with the Tribes holding mineral rights to 9.8% of the reservation lands and all of the submarginal lands. Therefore, the governmental authorities for the disposition of the contracts will be the tribal councils, allottees, and the trustee, the Bureau of Indian Affairs, acting in behalf of the Secretary of the Interior. Environmental assessments are currently being prepared by the BIA to aid in rapid implementation of a contract after economic analysis and approval by the BIA.

The Tribes have not enacted any specific codes, ordinances, regulations nor mineral taxes relating to oil and gas exploration and development, therefore the chief regulations governing oil and gas activities are those of Title 25 of the Code of Federal Regulations (CFR) Subchapter 1 - Energy & Minerals (Part 225 applicable to P.L. 97-382 CFR, Part 216 (applocable to revenue reporting and payments) and Title 43 CFR Part 3160 (applicable to production reporting and operating procedures.

The Bureau of Indian Affairs Billings and Aberdeen Area Offices have entered into a memorandum of understanding with Montana State Office of the Bureau of Land Management (BLM) whereby BLM will provide certain oil and gas management operations on Indian lands.



Regional Geology

The Fort Belknap Reservation is situtuated on the northern flank of the Little Rocky Mountains, an early Tertiary intrusion. (see figure 1 cross-section and map). The reservation is west of the Bowdoin Dome, east of the Bearpaw Uplift and south of the Hogland Basin.

The geologic section is represented by Pre-Cambrian metamorphics, Paleozoic carbonates and Jurassic and Cretaceous sandstones. The Paleozoic rocks are mainly dolomites and limestones deposited within the Williston Basin and Alberta Shelf depocenters. Jurassic and Cretaceous rocks vary from continental to marine sandstones and shales.

Most of the reservation is overlain by Quaternary alluvium deposits, Cretaceous Bearpaw shale (high bentonite content) and Judith River sandstones and siltstones.

Exploration History

Only 10 wells have been drilled to date on the reservation with no commercial success. However, significant gas shows have been encountered in 3-4 wells just outside the reservation boundary.

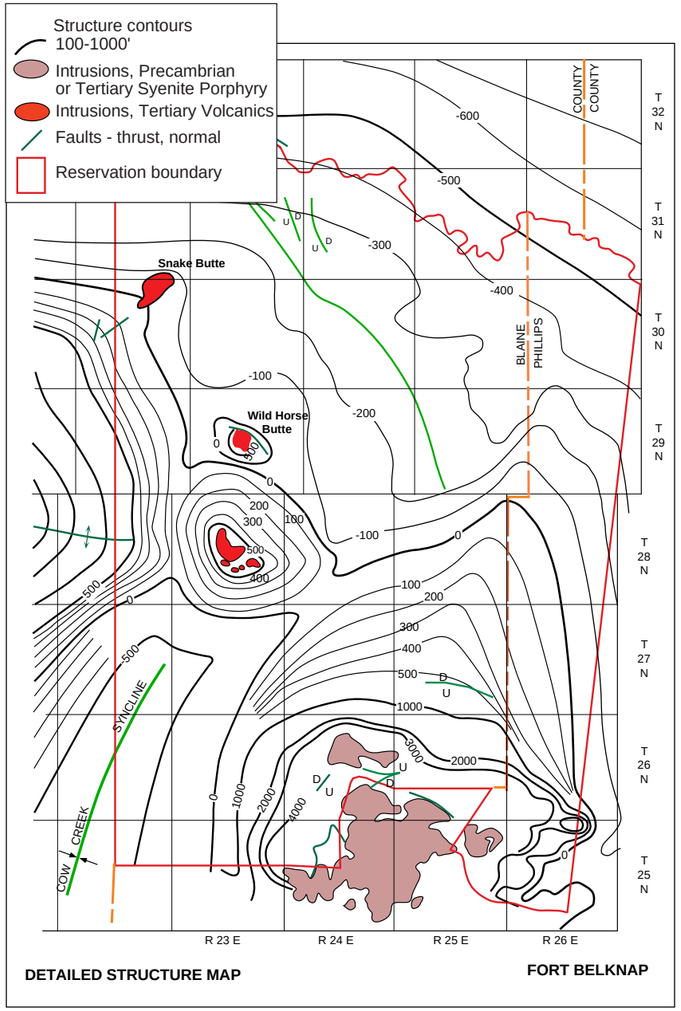


Figure BK-2.2. Detailed structure map of Fort Belknap Reservation (after Knechtel, 1959).

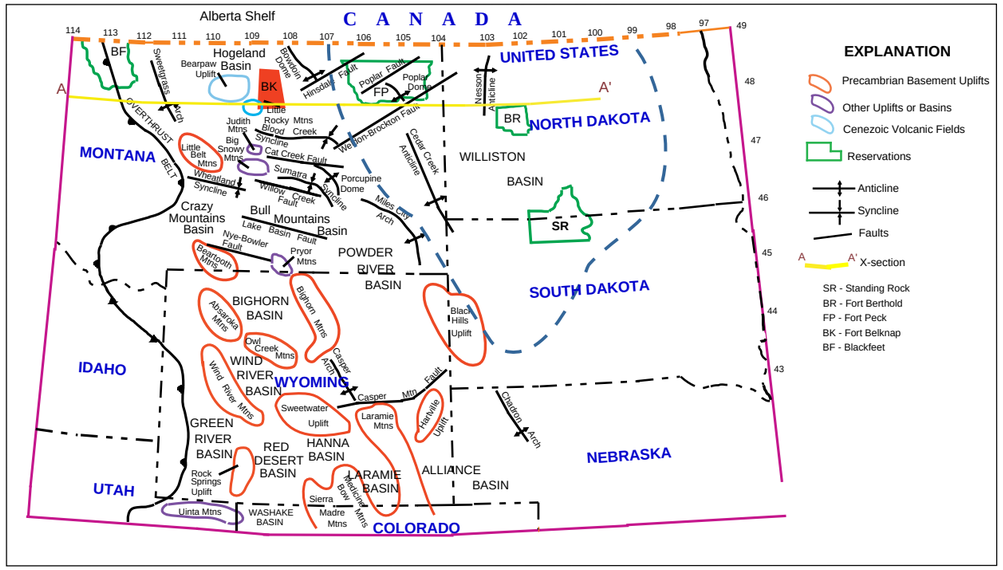


Figure BK-2.1. Present day structural features in the Rocky Mountain region (after Peterson, 1987).

Structural Geology

The Fort Belknap Reservation is dominated by the Little Rock Mountains of Paleocene-Eocene age. The Little Rocky Mountains are a series of igneous intrusions (Seyenite Porphyries) that have generated numerous structural domes (over 50) of various sizes (see detailed structure map). Several domes have been breached by erosion and expose the igneous core. Others have Paleozoic rocks exposed at the surface. Dips within the complex area are steeply tilted to vertical. Dip decreases away from the dome to about 80 feet/mile. The southern end consists of several domes, averaging two to three miles in diameter. Small intrusions are present on the western edge of the reservation (Snake Butte, Wild Horse Butte).

The Bearpaw Uplift, located west of the reservation, is also Tertiary in age and consists of a series of intrusions and complex thrust and normal faults. As the Bearpaw intrusion was emplaced, the paleo gas field that existed in the Cretaceous sands was broken, carried by landslides into downdip positions. The Bearpaws' contain large, shallow gas fields trapped in these "landslide" fault blocks.

The northern part of the reservation is mainly of gentle dip, although a major thrust fault (present at the surface) trends northwest to southeast. It's orientation suggests it is related to the fault systems that were created during the Bearpaw intrusive episode. Smaller folds and faults have been identified from surface geology.

Most Likely Hydrocarbon Zones

Based on current gas shows and regional hydrocarbon production, regional cross-sections and depositional maps, the most likely plays to develop on the Fort Belknap Reservation are:
1) Cretaceous rocks-Upper Cretaceous section is very thick; gas shows; high potential for Eagle sand biogenic gas accumulations.
2) Cretaceous rocks-discontinuous reservoir rocks encased within marine shales; Bowdoin, Virgelle sandstones and Greenhorn Limestone. Biogenic gas accumulations are possible.
3) Jurassic and Lower Cretaceous rocks-no shows reported, but lack of well control does not preclude biogenic gas potential.
Note: Paleozoic rocks are not considered prospective due to exposure at the surface in the Little Rocky Mountains at the south end of the reservation. Those rocks are open to the atmosphere and would be charged with fresh water. The Mission Canyon Limestone is cavernous where exposed, and is an excellent aquifer. Other Paleozoic units penetrated by well control have been found wet.

PRODUCING HORIZON LEGEND

ERA	SYSTEM	SERIES		WILLISTON BASIN	POWDER RIVER BASIN	WESTERN WYOMING SOUTHERN MONTANA	WESTERN & NORTHERN MONTANA
CENOZOIC	TERTIARY			Fort Union	White River Wasatch Fort Union	Green River Wind River Wasatch Fort Union	Fort Union
MESOZOIC	CRETACEOUS	UPPER		Fox Hills Judith River Eagle Niobrara Greenhorn	Lance Teckla Mesaverde Teapot Parkman Sussex Shannon Niobrara Frontier	Lance Fox Hills Mesaverde Cody Shannon Niobrara Frontier	Hell Creek Judith River Clagget Eagle Telegraph Creek Niobrara Greenhorn Frontier
		LOWER		Dakota Group	Mowry Muddy Dakota Fall River Lakota	Mowry Muddy Bear River Dakota Cloverly	Blackleaf Bow Island Kootenai Cat Creek Moulton Sunburst Cut Bank
	JURASSIC			Morrison Ellis Group Swift Reirdon Piper Nesson	Morrison Sundance Canyon Springs Gypsum Spring	Gannet Morrison Sundance Stump-Preuss Twin Creek	Morrison Ellis Group Swift Reirdon Sawtooth
	TRIASSIC			Spearfish	Chugwater Spearfish	Nugget Chugwater Ankareh Thaynes Woodside	
PALEOZOIC	PERMIAN			Minnekahta Opeche	Goose Egg	Dinwoody Phosphoria Park City	
	PENNSYLVANIAN			Minnelusa Amsden Tyler	Minnelusa	Weber Tensleep Amsden Darwin	Amsden Tyler
	MISSISSIPPIAN			Big Snowy Group Heath Otter Kibbey Madison Group Charles Mission Canyon Lodgepole	Madison Englewood	Madison Mission Canyon Lodgepole	Big Snowy Group Heath Otter Kibbey Madison Group Sun River Charles Mission Canyon Lodgepole
	DEVONIAN			Bakken Three Forks Nisku Duperow Souris River Dawson Bay Winnipegosis	Jefferson	Jefferson Darby	Three Forks Nisku Duperow Souris River
	SILURIAN			Interlake	Interlake		
	ORDOVICIAN			Stonewall Stony Mountain Red River	Big Horn Winnipeg	Big Horn	Red River
	CAMBRIAN			Winnipeg Deadwood	Deadwood	Gallatin Gros Ventre Flathead	Emerson Flathead

S = Source Rock

Figure BK-2.3. Detailed stratigraphic column of Fort Belknap area (after Peterson et al, 1987).

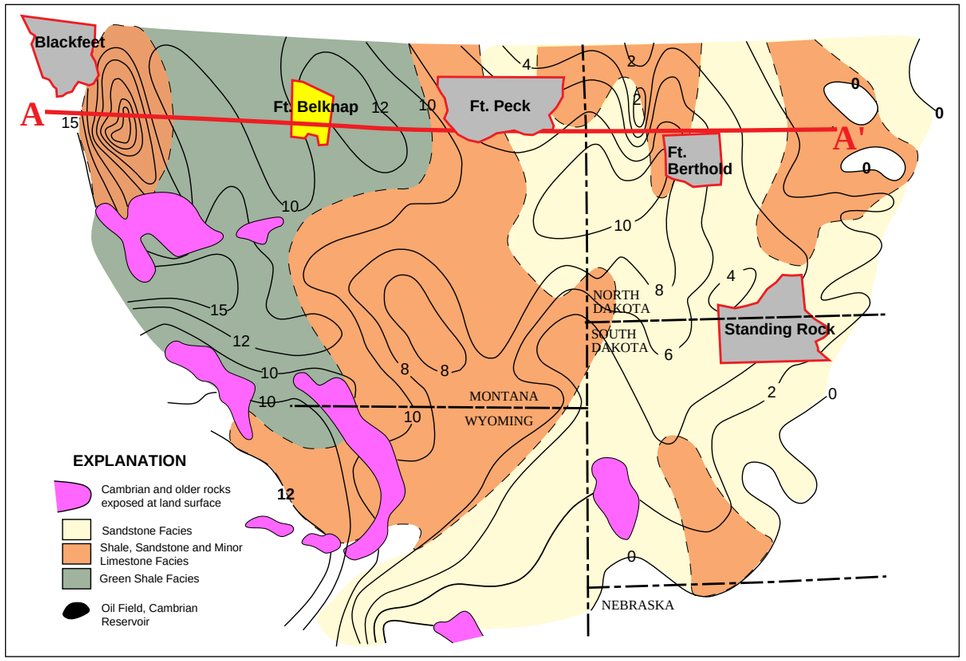


Figure BK-3.1. Thickness in hundreds of feet and rock facies map of Deadwood Formation or equivalent rocks. (Cambrian and Lower Ordovician)

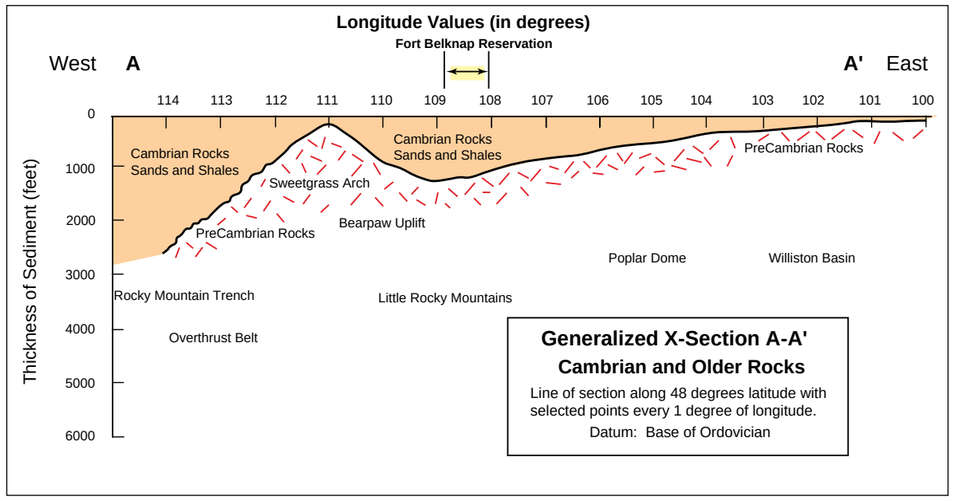


Figure BK-3.3. Generalized time-interval cross-section for Cambrian and older rocks along line of section A-A'.

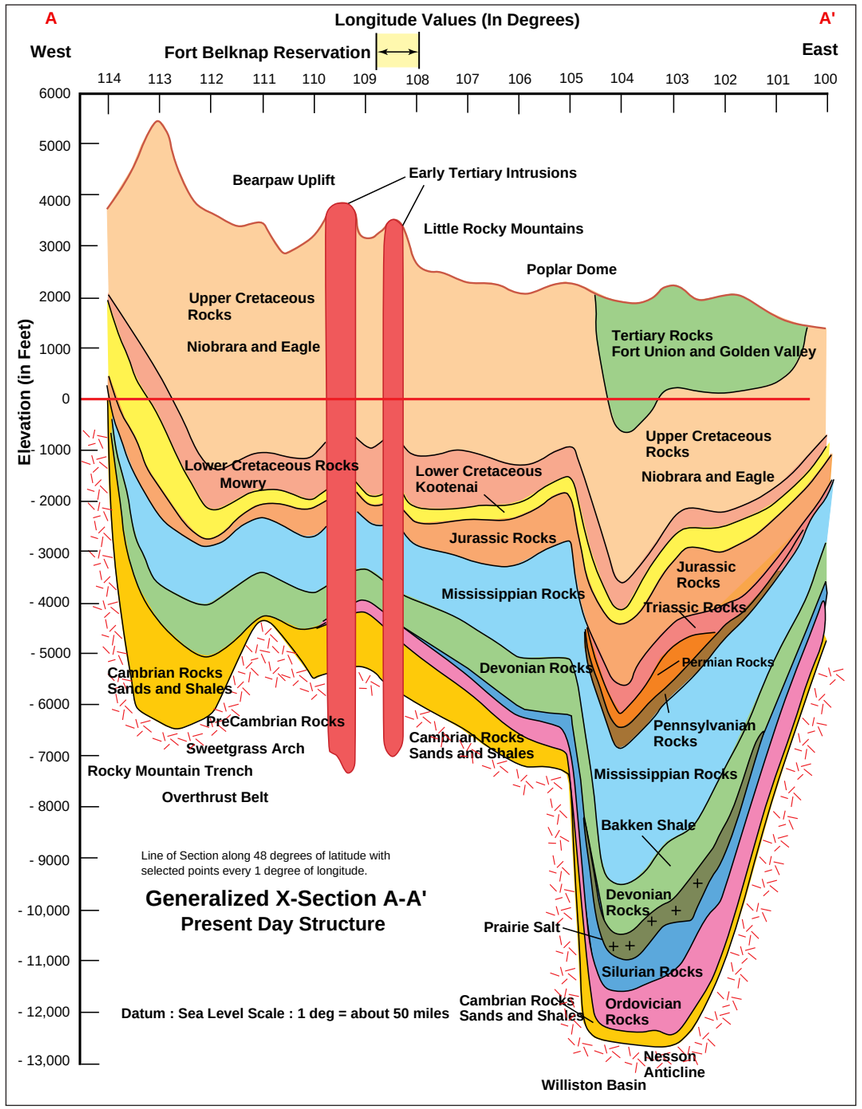


Figure BK-3.2. Generalized cross-section A-A'

GEOLOGIC HISTORY

One generalized structural cross-section (see cross-section A-A') has been constructed to summarize present day tectonic provinces and older paleostructure. The cross-section uses rock thickness values from each of the geologic periods. Section A runs along the 48 degree latitude line and values were selected at one degree longitude intervals. The western end of the section, near the Blackfeet Reservation is dominated by high relief (greater than 5000 feet). The Cretaceous and older Paleozoic section is about 11,000 feet thick. Major basement uplifts, such as the Sweetgrass Arch and the Bearpaw Uplift, influenced sedimentation throughout geologic time.

The eastern side of the cross-section is dominated by the Williston Basin, a stable cratonic depocenter which contains more than 15,000 feet of sediments. The center part of the illustration is influenced by the Bearpaw Uplift and the Little Rocky Mountains Tertiary intrusions. The southern end of the reservation is located on the Little Rocky Mountain intrusion.

To better illustrate the geologic history of the region, which has been influenced by all of these tectonic provinces, a series of paleo cross-sections are shown. Each section summarizes a particular time interval; Cambrian and older rocks, Ordovician to Triassic and Cretaceous to Jurassic. Since Tertiary sediments are present only in the Williston Basin, no paleostructure section is shown.

A paleo cross-section attempts to show what the subsurface geology may have looked like within that time interval. For the sake of space, only the particular interval is shown; no rocks older than it are illustrated. The rock units above the interval have not yet been deposited; the top of the section is the datum. The datum is flat, representing the paleo ground surface.

Cambrian and Older Rocks

Oldest rocks exposed at the Fort Belknap Reservation are metamorphosed sedimentary and igneous rocks. These rocks are mainly biotite schist and gneiss. Some metavolcanics are present as hornblende gneiss and amphibolite.

During Cambrian time, a major seaway existed in western Montana and eastern Idaho. This seaway gradually transgressed from west to east across eastern Montana and the Dakotas. The major source of coarse-grained clastics was to the east (from the Sioux Arch) and graded into shales and limestones to the west. Thickness of the Cambrian rocks varies from over 2000 feet thick in the Montana Disturbed Belt to less than 100 feet thick at the eastern edge of the Williston Basin. Cambrian rocks at the Fort Belknap Reservation are represented by the Flathead Sandstone and are about 1000 to 1100 feet thick. There is no evidence of any structural features at this time.

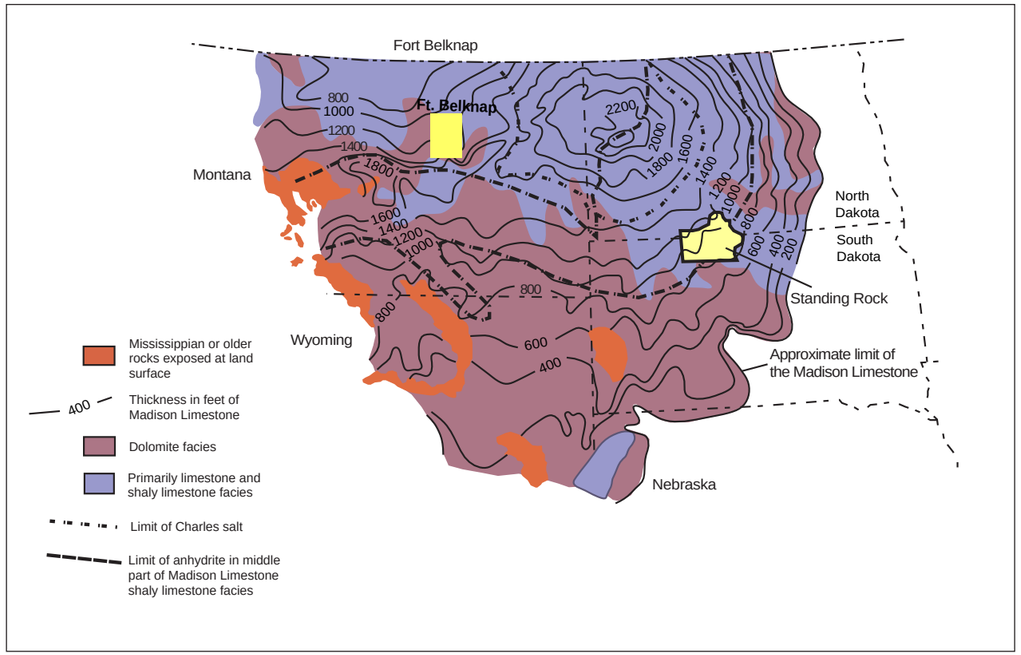


Figure BK-4.1. Thickness in feet and generalized rock facies of the Madison group (Mississippian) and equivalent rocks (modified after Peterson, 1981, 1984).

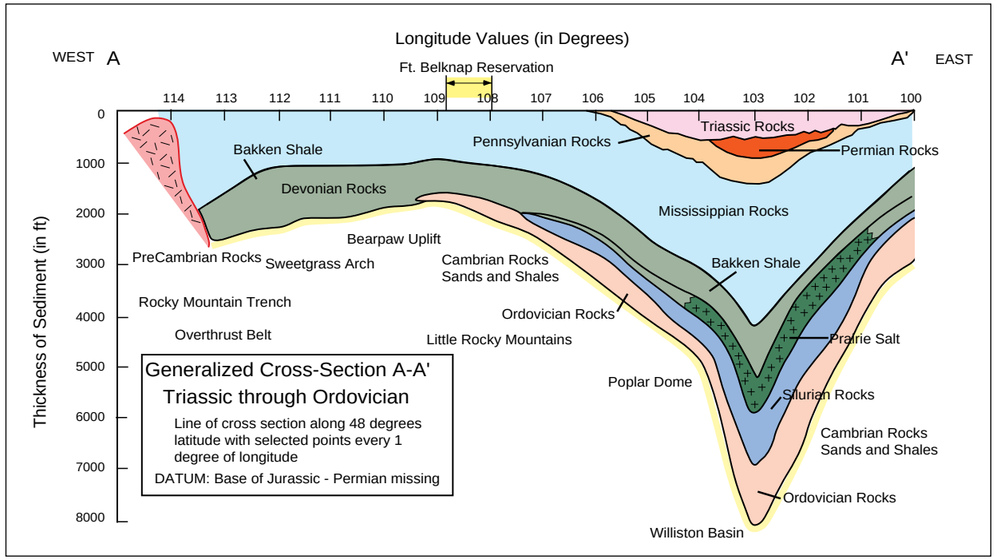


Figure BK-4.2. Generalized time-interval cross-section of Triassic through Ordovician rocks.

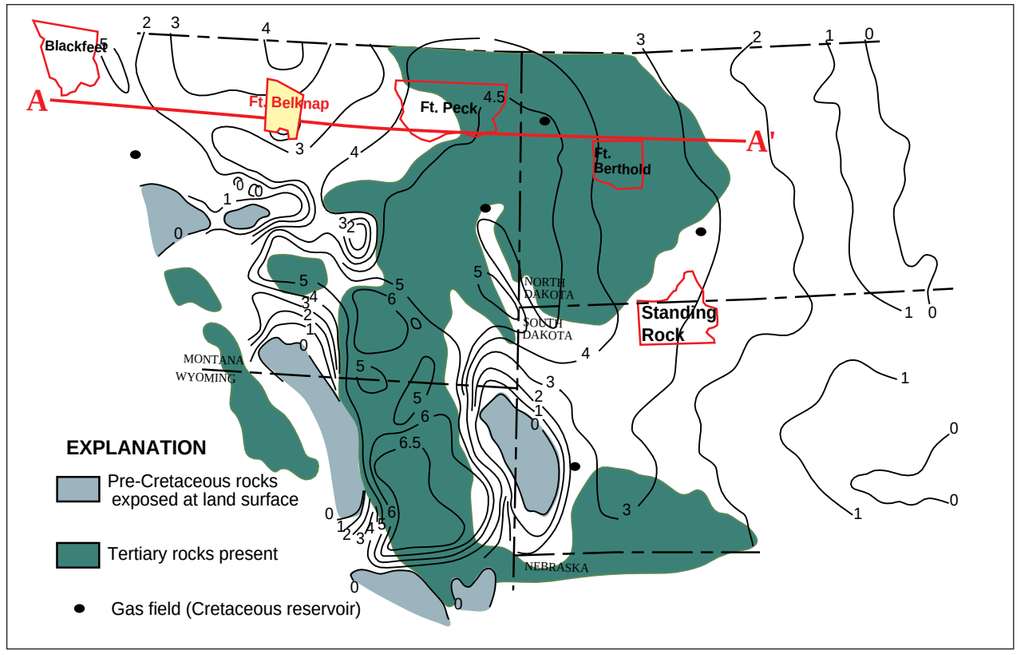


Figure BK-4.3. Thickness of Cretaceous rocks in thousands of feet, showing areas where Tertiary rocks are present. Gas fields producing from Cretaceous sandstones are outlined (modified after McGookey et al. 1972).

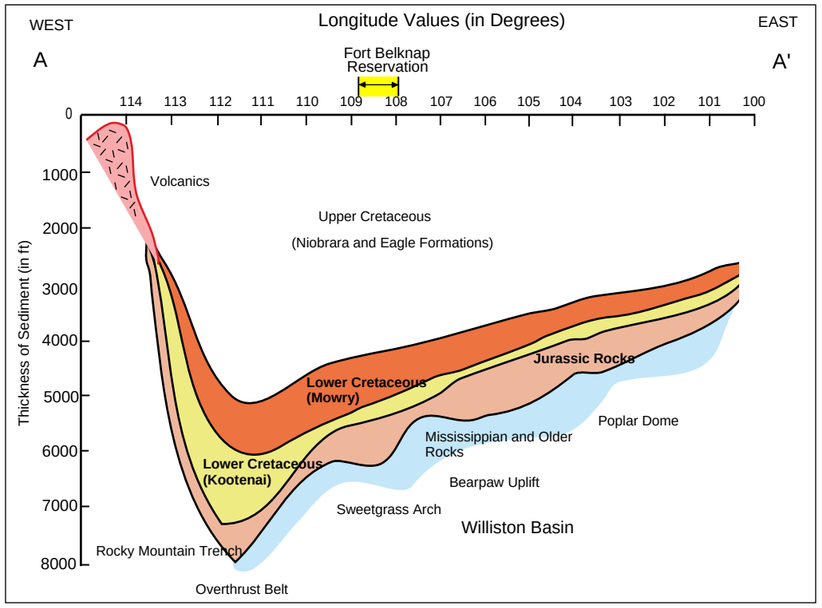


Figure BK-4.4. Generalized time-interval cross-section of Cretaceous and older rocks along A-A' line of section.

Ordovician to Mississippian Rocks

From late Cambrian through most of the Paleozoic, the Williston Basin on the east side of the cross-section was the dominant receiver of sediments (see cross-section A-A', and Figures BK-4.1. and BK-4.2.). The Williston Basin has been a stable, shallow marine shelf through most of the Paleozoic Era. Ordovician and Silurian rocks were deposited in a tidal flat environment with alternating cycles of limestone/dolomite, marine shales and evaporites. At the end of Silurian time, a regional unconformity extended across the Williston Basin and to the west. Present thickness of Ordovician rocks on the Fort Belknap Reservation are from 120 to 300 feet. The Silurian is not present (either having never been deposited or having been completely eroded).

Devonian deposition was similar to that in Ordovician time. Within the reservation boundaries, these rocks are about 600 to 1100 feet thick, thickening northward, and include the Jefferson Group (possible Duperow rocks) and the Three Forks Shale.

Mississippian rocks thicken southward towards the Big Snowy trough. Included within the period are Lodgepole Limestone and Mission Canyon Limestone. The Mission Canyon is coarse grained with numerous solution cavities at the top of the unit. Total thickness of Mississippian rocks varies within reservation boundaries from 700 to 1100 feet thick.

A major unconformity at the end of Mississippian time led to widespread erosion and karstification. Pennsylvanian sediments are confined to the center of the Williston Basin and are in central Montana south of the reservation, in the Big Snowy trough. No Pennsylvanian, Permian or Triassic rocks are present at Fort Belknap.

Jurassic to Cretaceous Rocks

In Jurassic time, the Williston Basin was still the major depocenter for clastic and marine carbonate/evaporite sediments although the focus of deposition shifted to the west (Figure BK-4.4) Thickness of Jurassic rocks is estimated to be about 400 to 700 feet, thickening northward into the Hogland Basin.

Early Cretaceous rocks (Lower Kootenai) are about 150 to 300 feet thick at the reservation. The early lower Cretaceous is thought to have been a time of continental to nearshore deposits. Source area for these deposits (i.e., Lakota Formation) is thought to have been to the southwest in Montana and northern Wyoming.

The late, Early Cretaceous rocks (Colorado Group-Mowry/Skull Creek) are about 70 to 800 feet thick. These rocks were deposited in a transgressing marine sequence that extended from western Montana eastward into the Dakotas and from Texas into Canada. These rocks are represented by the Thermopolis, Mowry, and Warm Creek Shales. All are marine shales and impermeable.

Upper Cretaceous rocks (Montana Group) are from 3500 to 4000 feet thick at Fort Belknap. These rocks thicken southward into the Rocky Mountain trough. These units contain the Eagle and Judith River sandstones. The Bearpaw Uplift began to form at this time and created large scale gas traps.

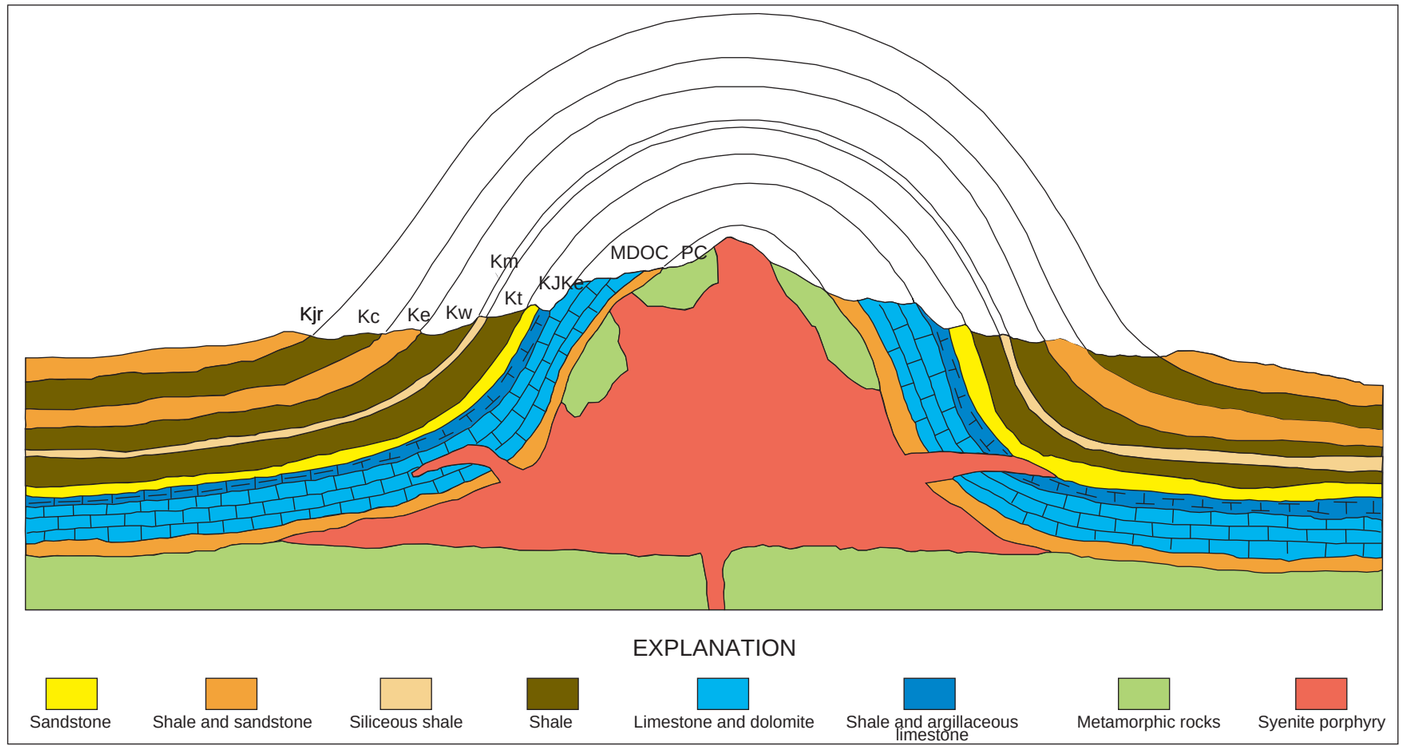


Figure BK-5.1. Schematic section through the Little Rocky Mountains, showing the laccolithic intrusion of syenite porphyry and the doming of the sedimentary rocks. Tsp, syenite porphyry; Kjr, Judith River Formation; Kc, Clagget Shale; Ke, Eagle Sandstone; Kw, Warm Creek Shale; Km, Mowry Shale; Kt, Thermopolis Shale; KJKe, Kootenai Formation and Ellis Group; MDOC, limestone and sandstone of Mississippian to Cambrian age: and PC, Precambrian rocks.

Tertiary and Younger

In early Tertiary time (Paleocene or Eocene), a large mass of syenite porphyry intruded the Precambrian basement rocks into a dome about 10 miles in diameter. Smaller intrusions formed to the northwest and include, Twin Buttes, Wild Horse Butte and Snake Butte. Erosion has since removed much of the sediment cover and exposes the syenite porphyry (Fig. BK-5.1).

The nearby Bearpaw Uplift was intruded by intense igneous activity which produced extrusive deposits (lava flows). Extensive landslides occurred on both the north and south flanks of the uplift. Subsurface well control shows volcanic flows resting on Lower Colorado Shale. The landslides formed both normal and thrust faults (at the head and toe of the slides). The displaced gas migrated to these new traps.

By Pliocene (mid-Tertiary) time, erosion had reduced both the Little Rocky Mountains and Bearpaws to low-lying hills. Detrital material extended many miles outward from the uplifts and were reworked as alluvial terraces. Pleistocene glaciation covered most of the reservation, although glaciers never overran the Little Rocky Mountains. After the retreat of the ice, glacial material was dropped, forming hummocky, poorly drained topography.

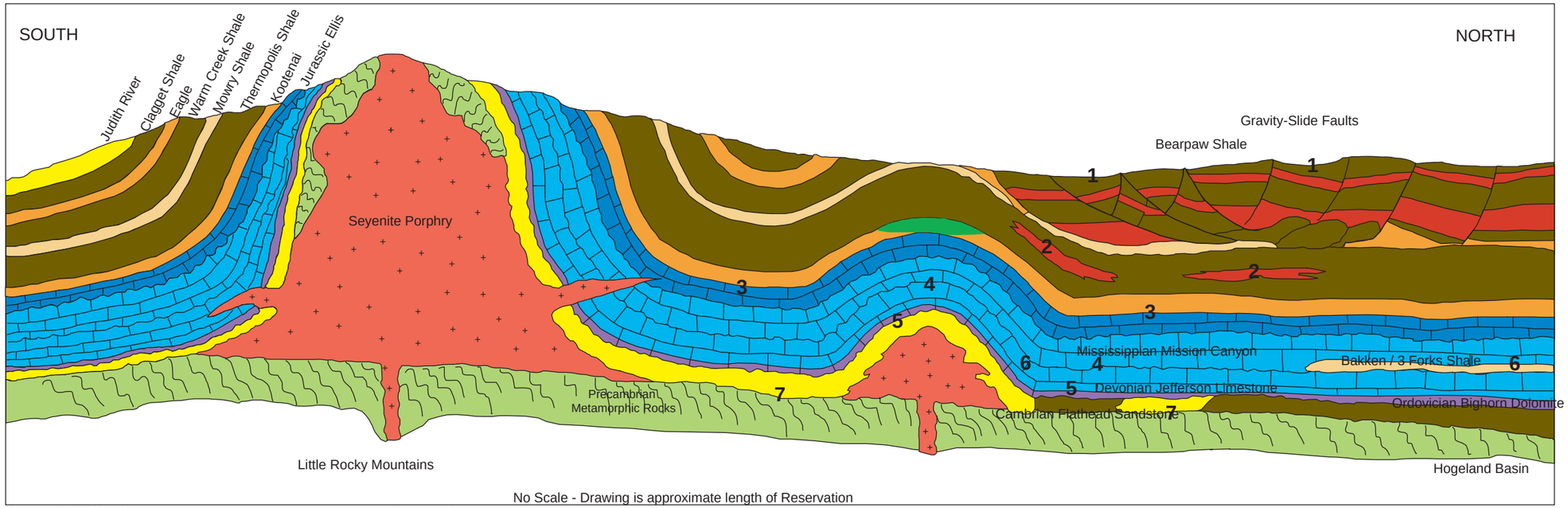


Figure BK-6.1. Schematic diagram of play types at Fort Belknap Reservation.

Play Types Explanation

(1) Shallow Cretaceous Biogenic Gas Play

(2) Northern Great Plains medium and low potential Biogenic Gas Play

(3) Jurassic / Cretaceous Sandstones

(4) Fractured / Folded Anticlines Mississippian Carbonate Play

(5) Mississippian and Devonian Carbonate Play

(6) Fractured Bakken

(7) Cambrian Sands

Sandstone
Limestone
Shale
Dolomite
Shales, sands and siltstones
Igneous/ Metamorphics
Gas
Volcanics
Oil
Intrusions
Gravity Slide Thrusts
Sandstone Lenses

Reservation: Fort Belknap
Geologic Province: North Central Montana
Province Area: North Central Montana (62,500 sq. miles)
Reservation Area: 947 sq. miles (606,080 acres)

Total Production (by province-1996) North Central Montana
Oil: 440 MMBO
Gas: 1.1 TCFG

Undiscovered resources and numbers of fields are for Province-wide plays. No attempt has been made to estimate number of undiscovered fields within the Fort Belknap Reservation

Play Type	USGS Designation	Description of Play	Oil or Gas	Known Accumulations	Undiscovered Resource (MMBOE) Field Size (> 1 MMBOE) min, median, mean	Play Probability (chance of success)	Drilling depths	Favorable factors	Unfavorable factors
Shallow Cretaceous Biogenic Gas Play **1**	2809	Porous and permeable sandstones of Upper Cretaceous age (Eagle and Judith River) Biogenic gas accumulations.	Biogenic Gas	Probably equivalent to accumulations at Tiger Ridge. 504,000 MMCF from numerous fields in Province	**Median:** 280 BCFG (14 fields @ 20 BCFG) **Field Size (>1 MMBOE)** 20 BCFG median 27.4 BCFG max **# of undiscovered fields (> 1 MMBOE)** 5 (min) 14 (median) 26 (max) 14 (mean)	1 0.50-0.70	700-3000 ft	1) gas shows southern end of reservation 2) shallow drilling 3) structures present; domes faults 4) source rock-self source	1) no production on reservation 2) lack of well control 3) reservoir rock unknown 4) size of accumulation unknown
Northern and Great Plains Medium and Low Potential Biogenic Gas **2**	2811 2812	Accumulations in Upper Cretaceous units; tighter siltstones and sandstones. May be equivalent to Eagle and Judith River formations.	Biogenic Gas	None known at this time.	**Median gas estimates** 17,366 BCFG median 20,479 BCFG mean **Low gas estimates** 12,409 BCFG median 15,353 BCFG mean	1 0.50-0.70	700-3000 ft	1) gas shows north and west of reservation, near Tiger Ridge 2) structures present; domes, faults. Source rock/ self source	1) no production on reservation 2) lack of well control 3) reservoir rock unknown 4) size of accumulation unknown
Jurassic, Cretaceous Sandstones **3**	2808	stratigraphic traps; discontinuous sands, undip pinchouts. Fluvial and nearshore sandstones.	Both	134 MMBO 318 BCFG 9 MBNGL (Most from Cutbank)	**Median:** 30 MMBO (15 fields @ 2 MMBO) **Field Size (>1 MMBOE)** 2 MMBO 9 MMBO 2.5 MMBO **# of undiscovered fields (> 1 MMBOE)** 6 (min) 15 (median) 28 (max) 15.8 (mean)	1 not estimated	1000-4000 ft	1) Gas shows north and west west of reservation 2) structures present; domes, faults 3) source rock/ self source	1) no production on reservation 2) lack of well control 3) reservoir rock unknown 4) size of accumulation unknown

Table BK-1. Play summary chart.

Reservation: Fort Belknap
Geologic Province: North Central Montana
Province Area: North Central Montana (62,500 sq. miles)
Reservation Area: 947 sq. miles (606,080 acres)

Total Production (by province-1996) North Central Montana
Oil: 440 MMBO
Gas: 1.1 TCFG

Undiscovered resources and numbers of fields are for Province-wide plays. No attempt has been made to estimate number of undiscovered fields within the Fort Belknap Reservation

Play Type	USGS Designation	Description of Play	Oil or Gas	Known Accumulations	Undiscovered Resource (MMBOE) Field Size (> 1 MMBOE) min, median, mean	Play Probability (chance of success)	Drilling depths	Favorable factors	Unfavorable factors
Fractured, folded anticlines in Mississippian Carbonates **4**	2807	folded structures, porosity controlled by matrix or fractures	Both	49.32 MMBO 21,506 MMCFG 585 MBNGL (numbers include Mississippian and Devonian play)	estimated 9 MMBO (9 fields@ 1 MMBO) **Field Size (>1 MMBOE)** 1 MMBO 3 MMBO 1.2 MMBO **No of Fields (>1 MMBOE)** 3 (min) 9 (median) 17 (max) 9.4 (mean)	1 not estimated	1,000-6,700 ft.	1) structures exsist; folds faults, domes 2) reservoir rock exists 3) regionally thermally mature	1) no production on reservation 2) rocks exposed to atmosphere at Little Rocky Mountains; strong hydro. gradient-flushed? 3) lack of well control
Mississippian and Devonian Carbonates **5**	2805	1) Jurassic/Mississippian regional unconformity traps 2) Devonian Structural Traps	Both	(see numbers from Mississippian)	estimated 48 MMBO (12 fields @ 4 MMBO) **Field Size (>1 MMBOE)** 4 MMBO 21 MMBO 4.8 MMBO **No of Fields (>1 MMBOE)** 3 (min) 12 (median) 21 (max) 12 (mean)	1 not estimated	1,300-7,000 ft.	1) structures exsist; folds, faults, domes 2) reservoir rock exists 3) regionally thermally mature	1) no production on reservation 2) rocks exposed to atmosphere at Little Rocky Mountains: strong hydro. gradient-flushed? 3) lack of well control
Fractured Bakken **6**	2804	Bakken/Exshaw Shale High organic content, thermally mature; fractured reservoir	Oil	Not applicable	Not estimated 18,000 BO / square miles 47,520 / square miles 5328 sq. mi. untested	0.25 0.2	5,000-10,000 ft.	1) Bakken regionally exists 2) thermally mature 3) structures and flexures exist	1) no existing production within province 2) no Bakken at southern end of reservation 3) no deep well control
Cambrian Sands **7**	2802	Coarse sands trapped as pinchouts or on deeper structures	Both	Not applicable	estimated 2 MMBO (2 fields @ 1 MMBO) **Field Size (>1 MMBOE)** 1 MMBO 5 MMBO 1.3 MMBO **No of Fields (>1 MMBOE)** 1 (min) 2 (median) 4 (max) 1.1 (mean)	0.5 not estimated	1,700-7,000 ft.	1) structures exist; folds, faults, domes 2) reservoir rock exists	1) no existing production within province 2) rocks exposed to atmosphere at Little Rocky Mountains: strong hydro. gradient-flushed? 3) source rock unknown 4) thermal maturity unknown 5) lack of well control

Table BK-2. Play summary chart (continued)

Conventional Play

Hypothetical Play

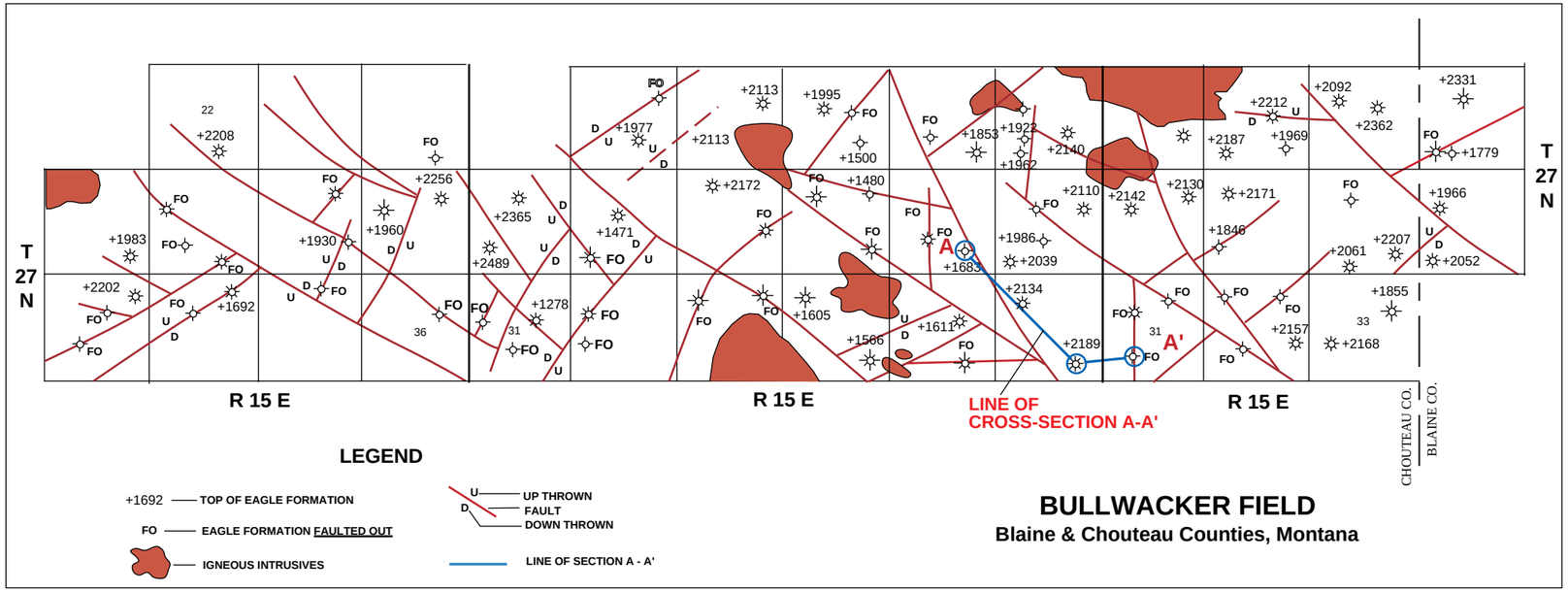


Figure BK-8.1. Bullwacker Field, Blaine & Chouteau Counties, Montana (after G.W. Shepard).

PLAY TYPE 1

Shallow Cretaceous Biogenic Gas

General Characteristics - This play is characterized by gravity-slide traps that formed during Tertiary time due to emplacement of igneous intrusions. Biogenic gas is trapped by fault blocks in Eagle and Judith River sandstones. Well control is sparse on the reservation, therefore, reservoir quality is speculative.

Reservoir rock at Tiger Ridge and other nearby fields is a fine to medium grained marine sandstone with porosities of 16-20% and permeabilities ranging from 9.5 to 110 millidarcies. Eagle sandstone thickness varies from 45 to 150 feet thick.

The north half of the reservation has surface expressed thrust and normal faults. Gas shows are present in areas south, west and north of the reservation boundaries.

Analog Fields (Outside reservation)

Bullwacker
Leroy
Tiger Ridge
Havre

Table BK-3. Bullwacker Field Parameters

Formation:	Upper Cretaceous Eagle Sandstone
Lithology:	continuous unit of fine to medium grained calcareous, marine sandstone, about 150 ft. thick
Porosity:	16 percent
Permeability:	No information available
Oil/Gas Column:	No information available
Average Net Pay:	40 feet net thickness
Other formations with shows:	Eagle gas shows and Judith River gas shows

Other information: Published literature suggests that permeabilities are low. Reservoir must be fractured before production.

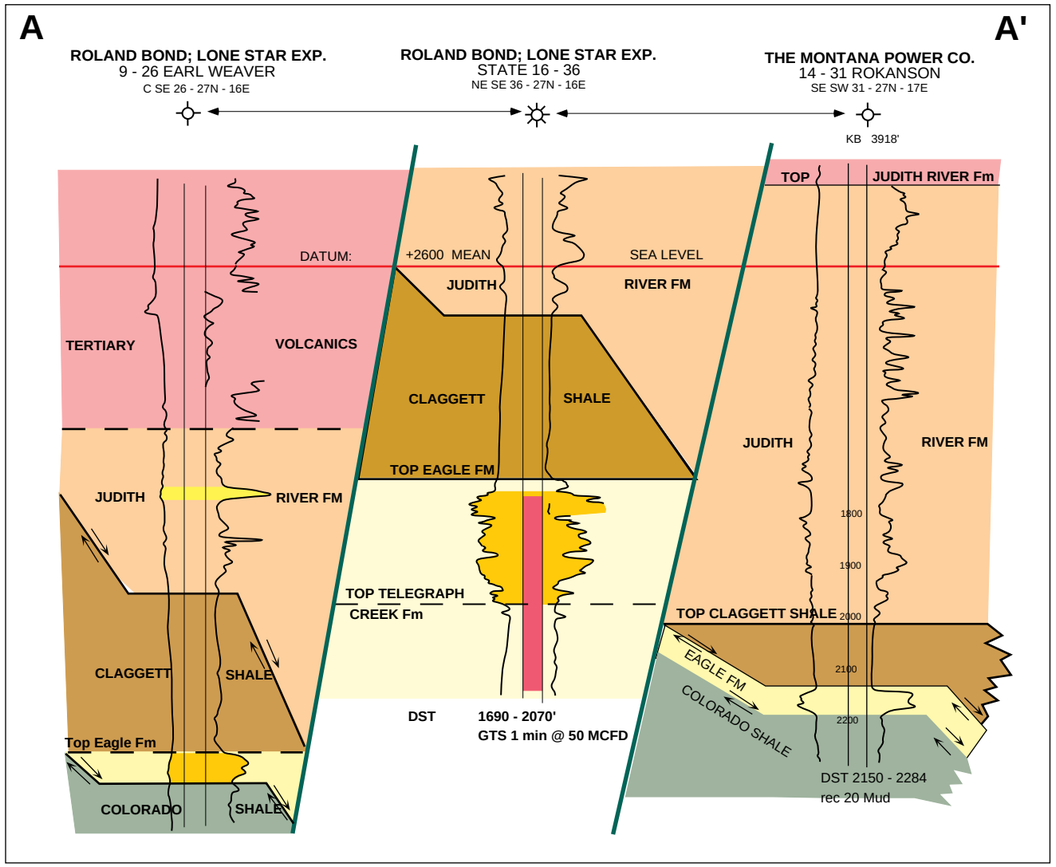


Figure BK-8.2. Structural cross-section A-A', Bullwacker Field (after G.W. Shepard).

STRUCTURAL CROSS SECTION A - A'

BULLWACKER FIELD

BLAINE & CHOUTEAU COUNTIES, MONTANA

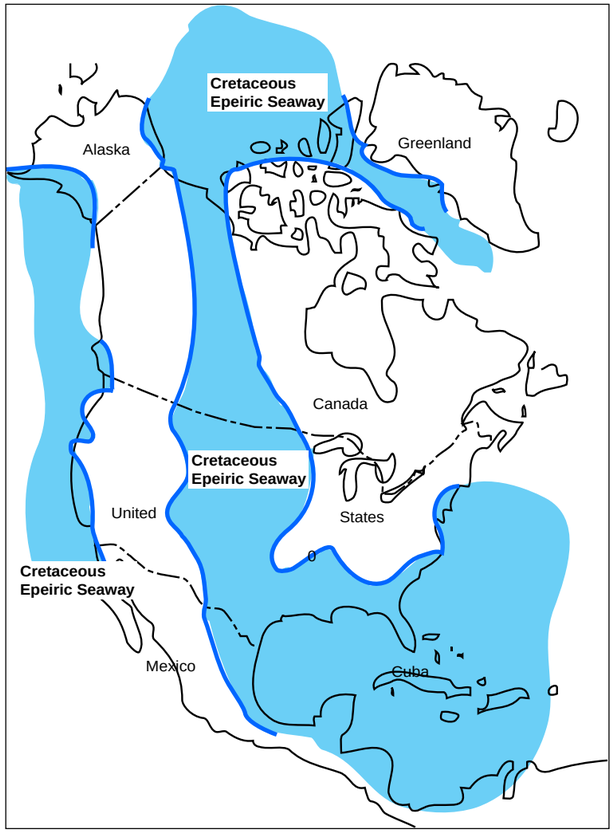


Figure BK-9.1. Paleogeographic map of North America during Late Cretaceous time, showing the Cretaceous seaway (after Rice and Shurr, 1980).

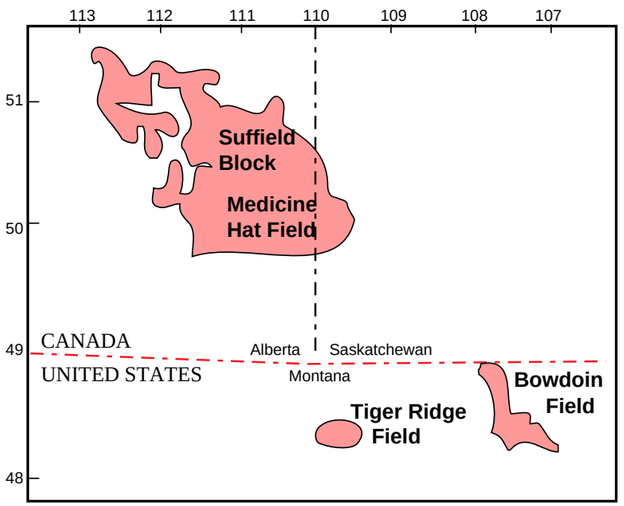


Figure BK-9.3. Distribution of shallow gas fields in north-central Montana, southeastern Alberta, and southwestern Saskatchewan. Bowdoin field and large area in Canada produce from low-permeability reservoirs. Tiger Ridge field produces from structural traps of conventional reservoirs.

PLAY TYPE 2

Northern Great Plains Biogenic Gas Play

(Medium - Low Potential)

General Characteristics - This play is characterized by very fine to fine-grained sandstones and siltstones within the Upper Cretaceous section of the reservation area. These rocks are equivalent to Eagle and Judith River sandstones at Tiger Ridge Field on the Bearpaw uplift (Figure BK-9.2 and 9.3). No production has been found to date within the Fort Belknap area. Tight gas sandstone production is present in nearby Leroy Field.

Reservoir rock at Tiger Ridge Field and other fields in the area is fine-medium-grained marine sandstones with high porosities and permeabilities. It is assumed that lower porosity and permeability values will be present within the reservation area. Potential reservoir intervals may be enhanced by location on paleostructure.

Trapping mechanisms could include fault traps, domes, and discontinuous sandstone lenses. Potential seal intervals may be sporadic and too porous for efficient gas trapping. The north half of the reservation has surface expressed thrusted and normal faulted horizons. Gas shows are present in areas south, west, and north of the reservation boundaries. It is unclear whether they are of thermogenic or microbial origin.

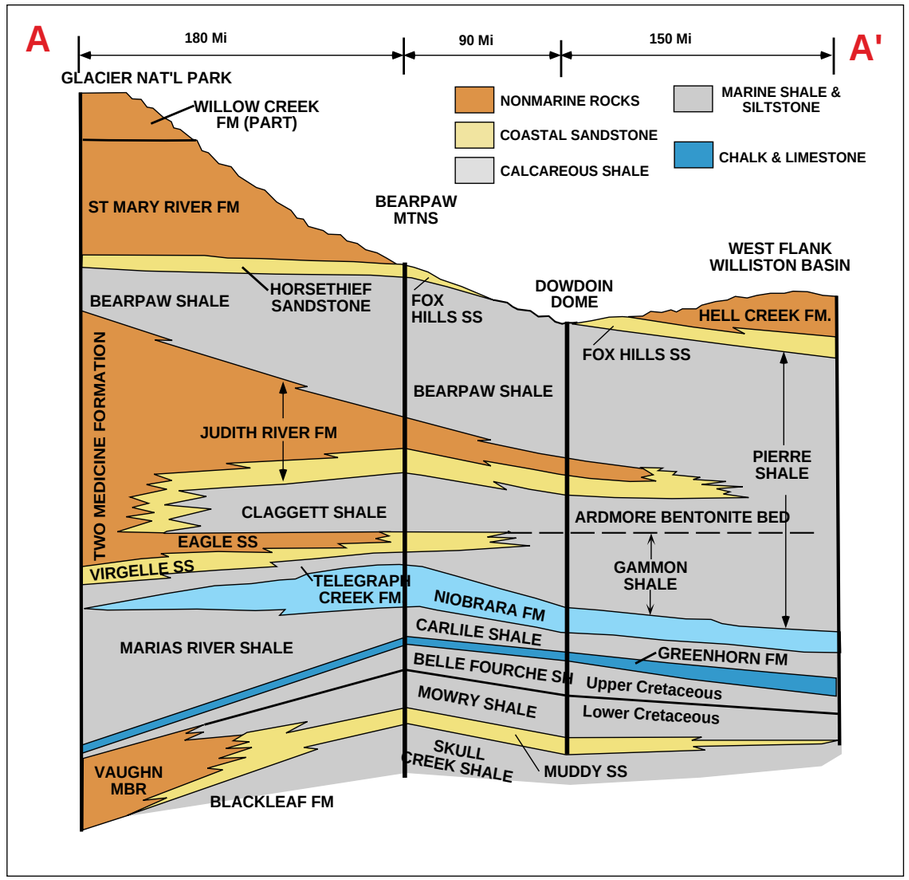


Figure BK 9.2. Diagrammatic sequence of selected Cretaceous Rocks from Glacier National Park to the west flank of the Williston Basin, Montana (after Rice and Shurr, 1980).

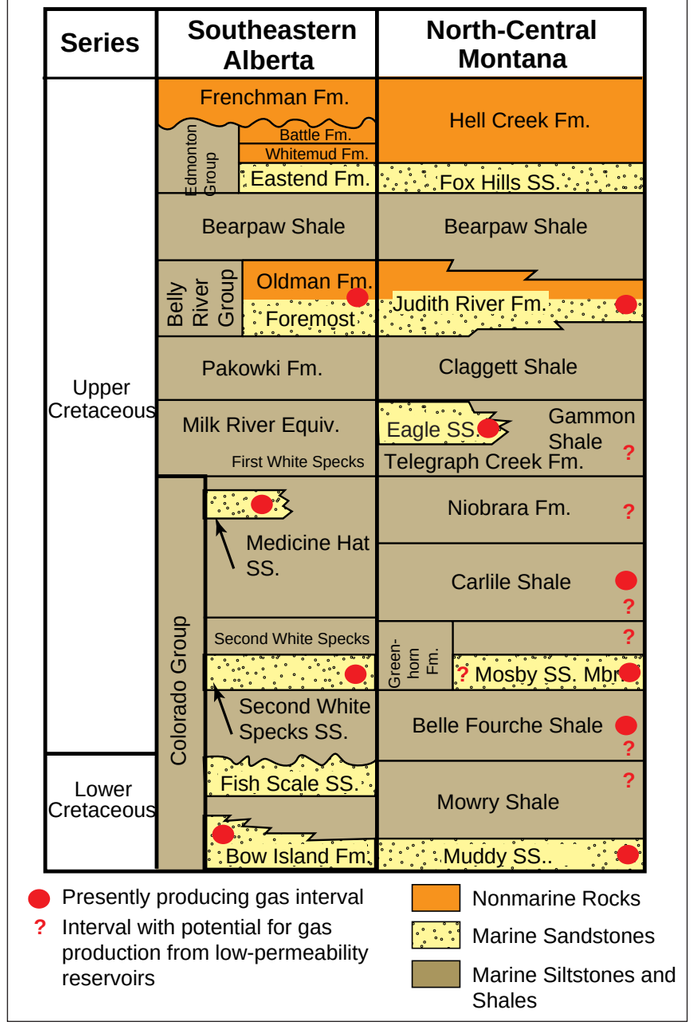


Figure BK-9.4. Correlation chart of selected Cretaceous rocks in north-central Montana and southeastern Alberta showing currently productive intervals and those with potential for gas production from low-permeability reservoirs.

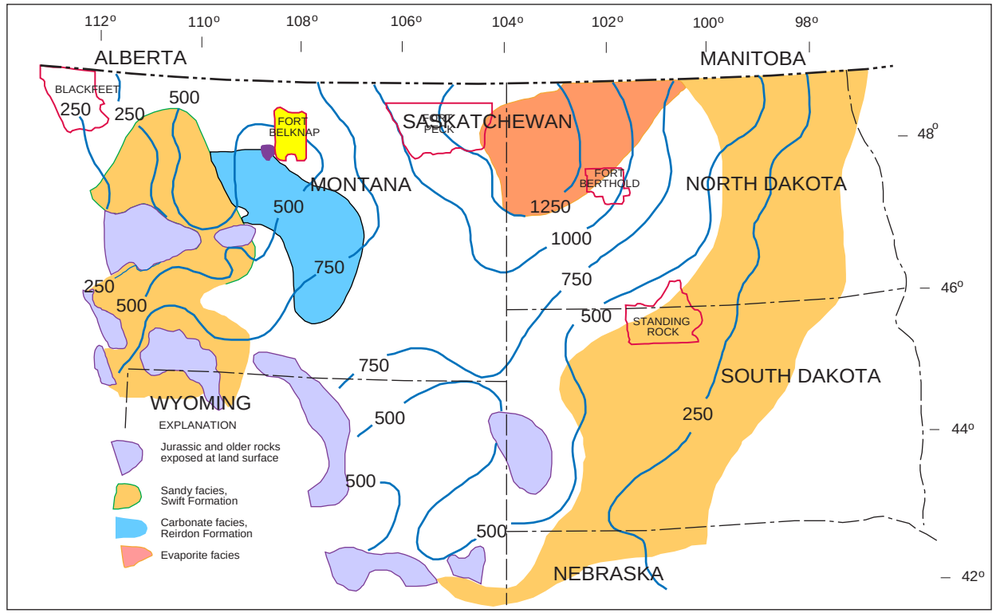


Figure BK-10.1. Thickness of Jurassic rocks in feet, showing approximate distribution of carbonate facies and evaporite facies (modified after Peterson, 1972).

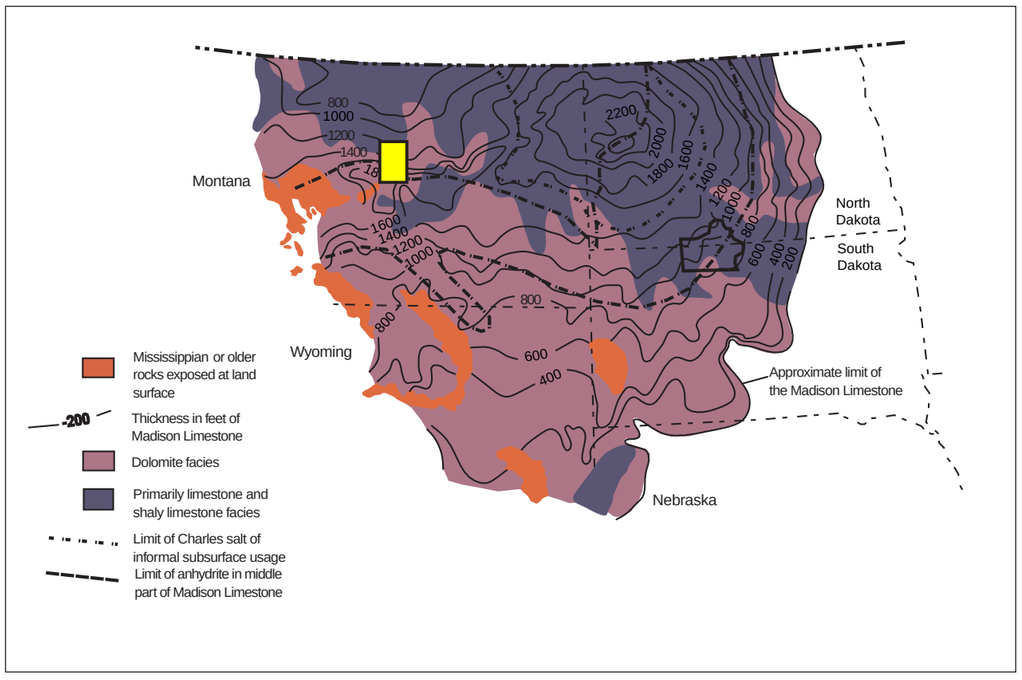


Figure BK-10.2. Thickness in feet and generalized rock facies of the Madison Group (Mississippian) and equivalent rocks (modified after Peterson, 1981, 1984b).

PLAY TYPE 3

Jurassic / Cretaceous Sandstones

General Characteristics- This play is characterized by possible traps in the Jurassic Swift / Ellis sandstone units and in the Lower Cretaceous Kootenai formation. No production has been established to date at either Fort Belknap or on the adjacent Bearpaw Uplift. Oil shows have been found in Jurassic rocks at Tiger Ridge Gas Field.

Trapping mechanisms include discontinuous sandstone lenses and sandstone pinchouts. One problem may be breached Jurassic / Cretaceous units exposed to the atmosphere in the Little Rocky Mountains, at the southern end of the reservation. A strong, hydrodynamic flow from south to north may have "flushed", hydrocarbons from the system.

PLAY TYPE 4

Fractured, Folded Anticlines in Mississippian Carbonates

General Characteristics - This play is characterized by possible traps in the Mississippian, Mission Canyon carbonate units. No production has been established to date at either Fort Belknap or on the adjacent Bearpaw Uplift. Trapping mechanisms include discontinuous porosity zones and structural traps.
One problem may be breached Mississippian and older units exposed to the atmosphere in the Little Rocky Mountains, at the southern edge of the reservation(refer to Figure BK-10.2).

The top of the Mission Canyon is cavernous and forms an excellent aquifer. This strong, hydrodynamic flow from south to north may have "flushed" hydrocarbons from the older rocks.

PLAY TYPE 5

Mississippian and Older Carbonates

General Characteristics- This play is characterized by possible traps in the Mississippian, Devonian and Ordovician carbonate units. No production has been established to date at either Fort Belknap or on the adjacent Bearpaw Uplift.

Trapping mechanisms include discontinuous porosity zones and structural traps. One problem may be breached Mississippian and older units exposed to the atmosphere in the Little Rocky Mountains, at the southern edge of the reservation. The top of the Mission Canyon is cavernous and forms an excellent aquifer. This strong, hydrodynamic flow from south to north may have "flushed", hydrocarbons from the older rocks. (Fig. BK-10.3 and BK-10.4)

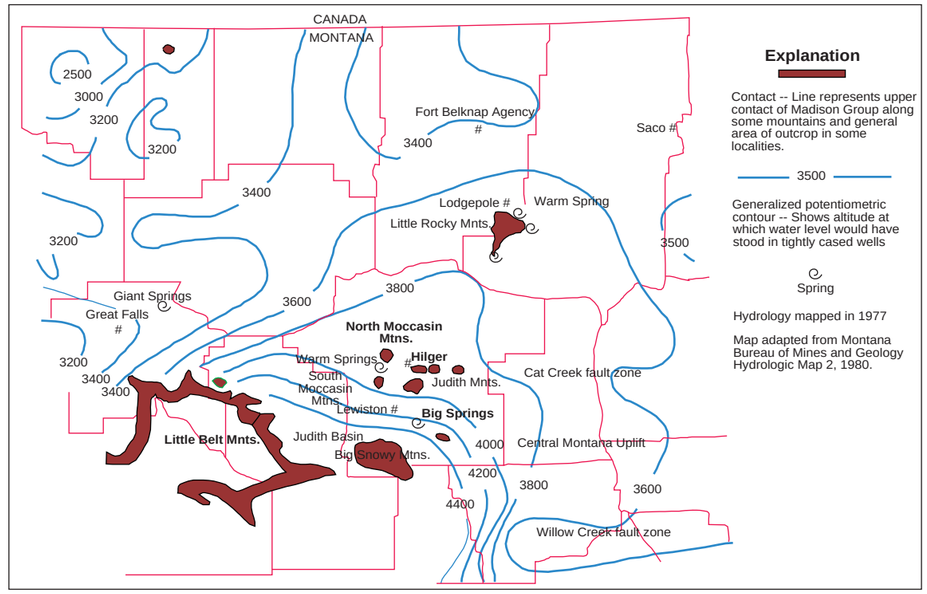


Figure BK-10.3. Potentiometric surface of water in the Madison Group, central Montana.

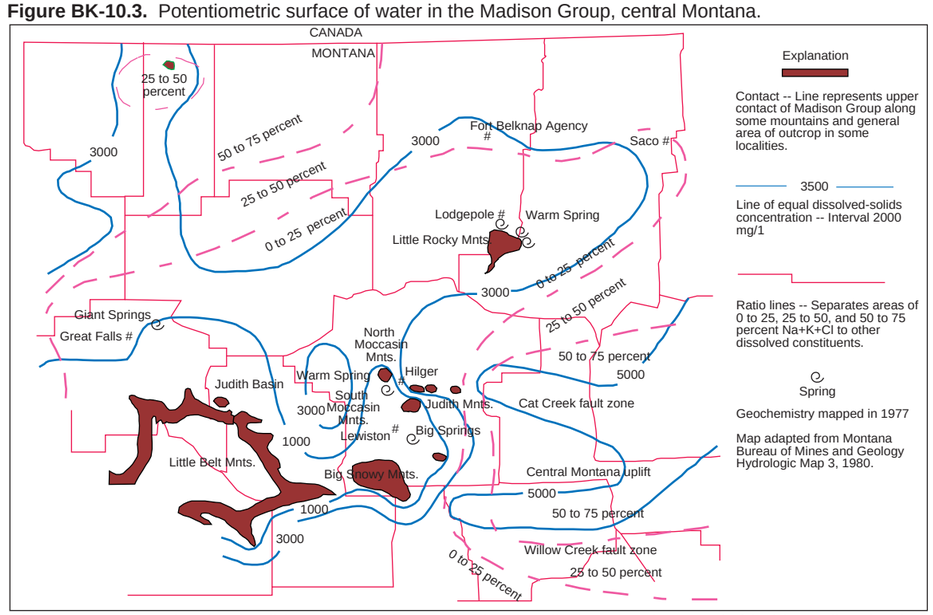


Figure BK-10.4. Dissolved solids concentration and ratio of sodium, potassium, and chloride to dissolved solids concentration in water of the Madison Group, Montana.

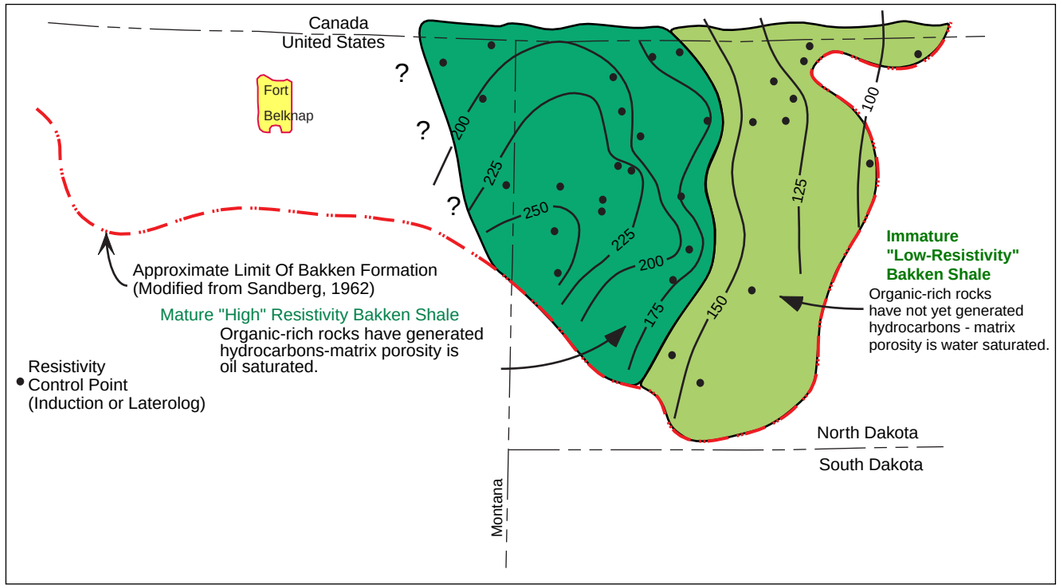


Figure BK-11.1. Areas of "high" and "low" electrical resistivity in Bakken shales, with subsurface isotherm contours (degrees) and interpreted area of source-rock maturity (after Meissner, 1987).

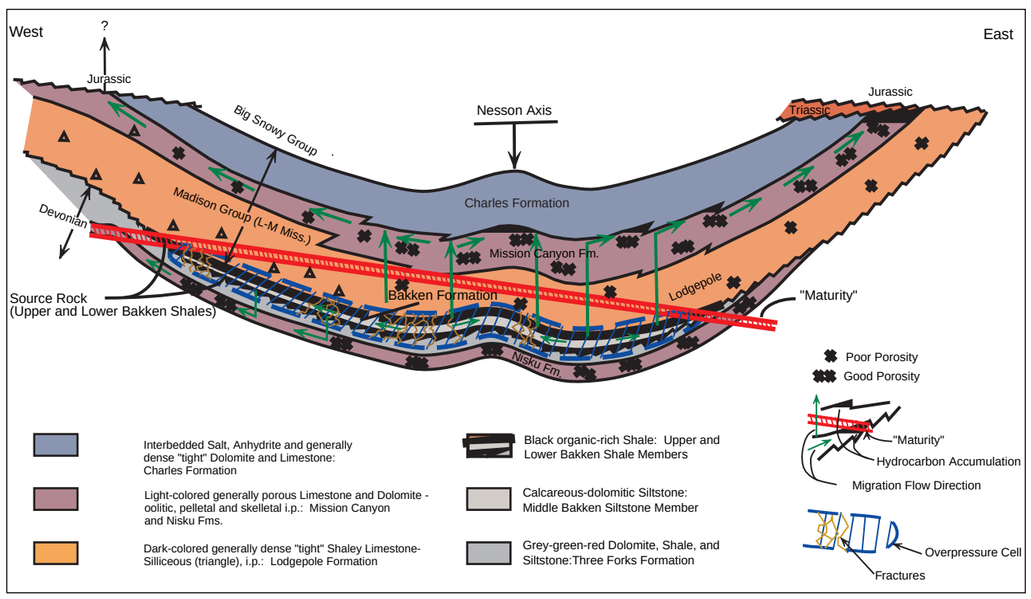


Figure BK-11.2. Schematic east-west section across the Williston Basin showing source-rock maturity, fluid over-pressure, fracture, migration and hydrocarbon accumulation patterns in the Bakken formation and adjacent units (from Messiner, 1984).

PLAY TYPE 6

Fractured Bakken Play

General Characteristics - This play involves possible fracture production from the Bakken/Three Forks shale. No production has been established to date within the Fort Belknap area or adjacent Bearpaw uplift. The Three Forks shale is poorly exposed in the Little Rocky Mountains at the southern end of the reservation. Organic content (quality and quantity) and thermal maturity are unknown.

Trapping mechanisms could include discontinuous fracture zones and possible structural closures. The northern end of the reservation is on the southern flank of the Hogeland sub-basin, where it is possible that the Bakken/Three Forks shale is better developed and thermally mature.

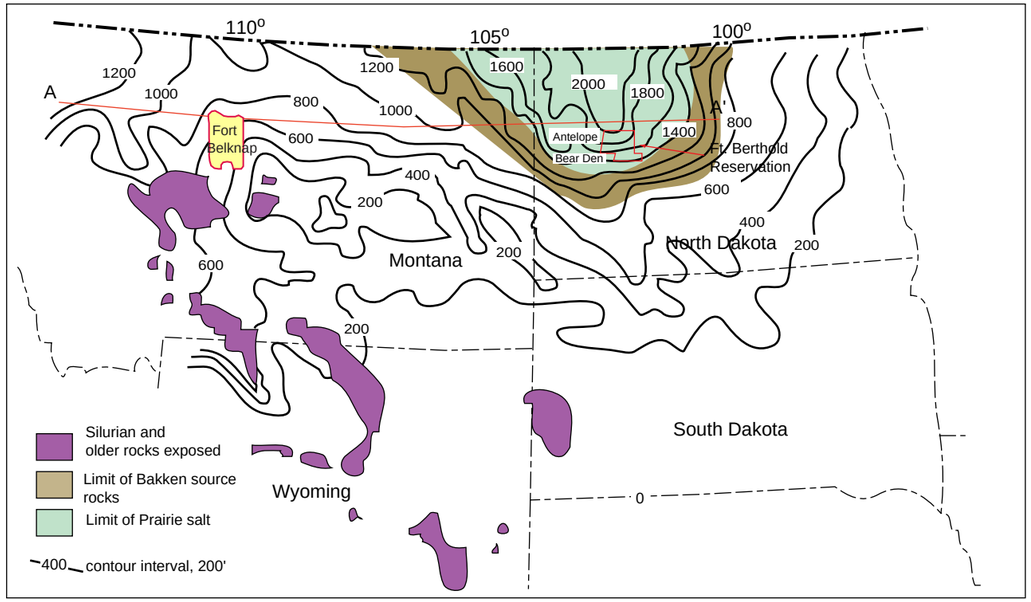


Figure BK-11.3. Map showing thickness of Devonian rocks, limit of Prairie salt, limit of Bakken source rock, location of analog fields and reservation, and location of regional cross-section A-A' (modified after Peterson, 1987).

PLAY TYPE 7

Cambrian Sandstone Play

General characteristics - The Cambrian Flathead sandstone may be a potential production horizon. No production has been established to date within the Fort Belknap Reservation or adjacent Bearpaw Uplift. The Flathead interval is well exposed in the Little Rocky Mountains at the southern end of the reservation. It is a fine-grained sandstone with some interbedded conglomeratic lenses and thick shale intervals (Fig. BK-11.4).

Since the Cambrian Flathead sandstone is exposed at the surface to meteoric influx, a hydrodynamic flow gradient from south to north may have flushed hydrocarbons from the older rocks.

Trapping mechanisms would include structural domes, fault traps, and sandstone pinchouts.

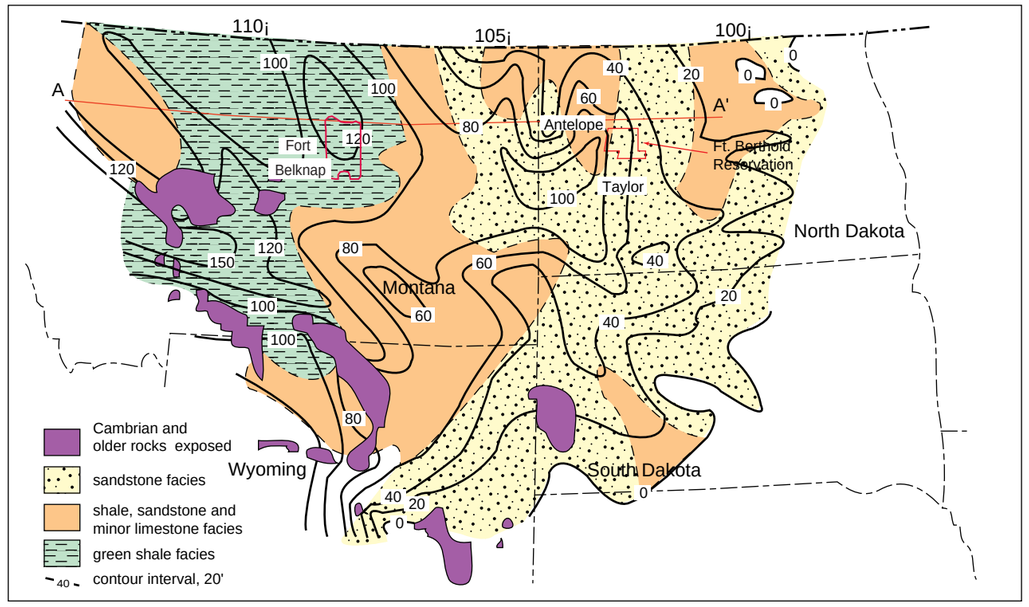


Figure BK-11.4. Thickness of Deadwood and equivalent rocks, location of analog fields, location of reservation, and location of regional cross-section A-A' (modified after Peterson, 1987).

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