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Update on Coal in Big Horn Basin, Montana and Wyoming

The Big Horn Coal basin is located within the topographic and structural basin of the same name and is defined by the limits of the Upper Cretaceous Mesaverde Formation in northwestern Wyoming and the Eagle Sandstone in south-central Montana. Eight coalfields in Wyoming and two in Montana occur in this large, asymmetrical, northwest-trending synclinal coal basin. While coal-bearing rocks are found in the Cloverly, Frontier, Lance, Willwood, Tatman, Judith River, Fort Union, Meeteetse, Eagle Sandstone, and Mesaverde formations, only the last four of these formations contain coal beds of economic significance.

The coal in this basin ranges in rank from high volatile C bituminous (based primarily on resistance to weathering) to subbituminous B coal. In general, the Mesaverde and Eagle coals are highest in heat content, averaging over 10,500 Btu/lb; the Fort Union coals in the Red Lodge–Bear Creek and Grass Creek fields average about 10,200 Btu/lb and are second highest in heating value. The Meeteetse Formation contains coals that average 9,800 Btu/lb, the lowest heating values in the basin. An average heating value for all coal in the basin is slightly less than 10,000 Btu/lb. The average sulfur content of all coals in this basin is less than 1%, with a range of 0.4 to 2.2%. For coals of economic interest in the basin, the Fort Union coals in the Grass Creek field are lowest in sulfur content, averaging 0.4%; the Fort Union coals in the Red Lodge–Bear Creek field are highest in sulfur, averaging about 1.9%.

Coal mining in the Big Horn Coal basin began in the late 1880s in the Red Lodge field and has continued to the present. Almost 53 million tons of coal have been mined in the basin; nearly 78% of this production (41 million tons) is from bituminous Fort Union coal beds in tho Red Lodge–Bear Creek and Bridger coal fields, Montana. Nearly all the production in Wyoming has been from Mesaverde coals in the Gebo field. Most of the coal was mined underground and was used by the railroads; maximum production for the entire basin was attained in 1920, when 2.4 million tons were produced. The only coal activity in the Big Horn basin at present is a small strip mine operated by Northwestern Resources at Grass Creek, Wyoming.

Original in-place resources for the Big Horn Coal basin are given by rank of coal: 1,265.12 million tons of bituminous coal resources have been calculated for the Silvertip field, Wyoming, and the Red Lodge–Bear Creek and Bridger fields, Montana; 563.78 million tons of subbituminous resources have been calculated for the remaining Wyoming coal fields. Remaining recoverable bituminous resources in coal beds over 28 in. (71 cm) thick and at depths less than 1,000 ft (300 m) are estimated at 400 million tons. Remaining recoverable subbituminous resources in coal beds over 5 ft (1.5 m) thick and under less than 1,000 ft (300 m) of overburden are estimated at 41.7 million tons, of which 18.6 million tons is considered strippable.

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Inferred Subsurface Ramp in Paris Thrust South of Pocatello, Idaho, and Petroleum Potential of Related Structural Features

Surface geology and gravity data suggest the presence of a major subsurface ramp zone in the Paris (Putnam) thrust beneath the mountain ranges south of Pocatello, Idaho. Immediately to the west a major thrust plate of mainly upper Paleozoic rocks (Hansel allochthon) overlies the Paris plate and conceals any evidence of the proposed ramp. Minor petroleum exploration work has been conducted in the general area of the ramp.

At localities in the Bannock Range, Blue Spring Hills, and Deep Creek Mountains, surface geology may indicate the presence of a steep ramp on the underlying Paris thrust. Recent mapping at the north end of the Deep Creek Mountains suggests the presence of an anticline west of Bannock Peak that has been disrupted by Basin and Range faults. This anticline lies at the structural contact between the area of upper Paleozoic rocks to the west (Hansel plate) and the area underlain by lower Paleozoic and Precambrian strata to the east (Paris plate). A similar structural-stratigraphic relationship is present locally in the Bannock Range and Blue Spring Hills. Restored cross sections, which have Basin and Range fault offsets removed, show that inference of a ramp on the underlying decollement at each locality helps to explain the observed structural-stratigraphic associations.

Preliminary analysis of gravity data supports the existence of a major thrust ramp beneath the mountain ranges south of Pocatello. A progressive eastward decrease in Bouguer anomaly values associated with pre-Tertiary rocks across the thrust belt begins in the Bannock Range, and may indicate that tectonic duplication of the sedimentary section has occurred as far west as the Bannock Range. The progressive eastward decrease in Bouguer values may reflect tectonic thickening associated with a significant ramp on the underling decollement.

Limited petroleum exploration work has been conducted along the exposed western margin of the Paris thrust plate and in the adjacent Hansel plate. Although near-surface strata in the Paris plate in the Bannock Range area lack hydrocarbon potential, it is possible that favorable stratigraphic units exist beneath the thrust at depth. The Hansel plate deserves additional exploration attention in that potential reservoir facies of the thick upper Paleozoic sequence are present in folded structures in the Blue Spring Hills and Sublett Range. Furthermore, the Manning Canyon Shale, which is a possible hydrocarbon source, is widespread in the Hansel plate. Structural complexity and high heat flow in the area have been the main deterrents to hydrocarbon exploration.

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Paleotectonic Controls on Sedimentation in Northern Williston Basin Area, Saskatchewan

The Williston basin lies within the so-called stable cratonic interior and would not be expected to have had the same intensity of tectonic activity as is generally considered to be characteristic of cratonic margin sedimentary basins. Local paleotectonic controls on sedimentation are much more subtle, thus sediment distribution patterns are commonly related to major regional structural elements such as the ancestral Williston basin and the Sweetgrass arch. From time to time, however, other structural features appear to have been effective controls on sediment distribution patterns. In southern Saskatchewan, one of the most active of these was the Swift Current platform. This feature appears to have been sufficiently positive during early Paleozoic time to have caused a distinct thinning of those sediments over it. But it is in early Middle Devonian time that it plays a more prominent role. During the time the Winnipegosis Formation was being deposited, the platform acted as a core for an accreting carbonate wedge that forms the southwestern margin of the Elk Point basin. Progressive inundation of the platform during the remainder of the Devonian made it a part of a broad, shallow shelf sea. However, it was a site of active local salt solution during that time, and may have been as well the locale for repeated accumulations of anhydrite deposits, particularly during the time the Duperow Formation was being laid down. The platform was mildly positive during other periods of sedimentation, as well as during periods of erosion. It was a site of widespread salt solution during Mesozoic time, which was also its time of major tectonic fluctuation, as well as being the period when it had the most significant influence on sedimentation.

Southeastern Saskatchewan is the locale for some significant regional gravity and magnetic anomalies which appear related to exposed structural zones in the Precambrian Shield. A major gravity anomaly on the extreme eastern side of the province is on trend with the Nelson River zone of Manitoba and a magnetic anomaly (Camfield-Gough conductor zone) can be traced to the Wollaston trend in north-central Saskatchewan. The existence of these two trends suggests that the regions proximal to them may have been tectonically active during various geologic periods. The Camfield-Gough zone is particularly significant in that it lies along the axis of the Hummingbird trough, an area affected by basement-controlled early salt solution, and it extends southward into the United States, where it is flanked by a number of local multizone oil-producing structures in North Dakota and Montana. The proximity of these structures to that conductor, which is thought to be a suture between two Proterozoic plates, suggests there is a relationship between them. Isopach and isochron maps have been used to show that these structures have been active during various geologic periods. Similar mapping techniques may show that similar structures are present in southeastern Saskatchewan.