objective. New production in this area, coupled with the surrounding well density, provides an ideal situation for further development of Tyler stratigraphic-seismic exploration concepts and methods.

Both geologic and geophysical Tyler thickness maps have proven to be useful tools in delineating eroded Heath and subsequent lower Tyler deposition. Seismic modeling has revealed a series of possible Tyler-Heath erosional edge characteristics, providing another tool for Tyler-Heath boundary definition. In modeling specific seismic sand signatures, it was found that seismic character and amplitude are dependent upon both formation thickness and lithology.

Detailed mapping of the study area also revealed a new environmental interpretation of the Tyler. Unlike the fluvial system to the north, the Tyler regime in the Rattler Butte area appears to have fluctuated among fluvial, deltaic, and marine systems.

Two hydrocarbon occurrence patterns have been noted within the Tyler: (1) although reservoir quality sands are present throughout the Tyler, those within the lower Tyler are more likely to contain hydrocarbons, and (2) close proximity to the Tyler-Heath erosional edge increases the chances of discovering oil-filled Tyler sands.

Combined use of these exploration tools should greatly enhance the chances for successful lower Tyler exploration.

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Fault Control of Channel Sandstones in Dakota Formation, Southwest Powder River Basin, Wyoming

The Dakota Formation is an important oil reservoir in the southwestern Powder River basin and adjoining Casper arch. Two fields, Burke Ranch and South Cole Creek, are used as examples to show the depositional environments of the Dakota and to indicate the influence of tectonic control on the distribution of the environments.

Burke Ranch field is a stratigraphic trap which produces oil from the upper bench of the Dakota. The environment of deposition of the reservoir, determined by subsurface analysis, is a channel sandstone. South Cole Creek field is a structural-stratigraphic trap which produces from the lower bench of the Dakota. Two distinct facies, a channel and channel margin sandstone, exist at South Cole Creek.

At both Burke Ranch and South Cole Creek it can be shown that the Dakota channels were deposited on the downthrown side of faults, which were present during Dakota time and which now are reflected on the surface by drainage patterns. An understanding of the environments of deposition of the Dakota and control of the environments by paleotectonics is necessary for exploration for these prolific reservoirs.

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Facies in Upper Part of Madison Group, Sawtooth Range, Northwestern Montana

Portions of the Mississippian Madison Group are gas reservoirs in the plains adjacent to the Sawtooth Range, northwestern Montana, and are equivalent to Mississippian carbonates that are major gas producers in the Canadian Foothills. In the Sawtooth Range, three facies are recognized in the upper 125 m (410 ft) of the Madison Group; they comprise a carbonate shelf sequence that is several hundred meters thick, shoals upward, and is unconformably overlain by Jurassic strata. Economically significant porosity may occur in the upper part of the Madison Group, controlled by the eogenetic secondary dolomitization of a conspicuous crinoidal grainstone unit within it.

This dolomitized crinoidal grainstone unit (termed facies C) is the lowest of three facies in the upper part of the Madison Group, and it abruptly overlies lagoonal limestone that forms the major part of the group. Facies C is massively bedded and exhibits large-scale planar cross-stratification suggestive of its origin as a subaqueous dune field. Measured porosity in surface samples of the dolomitized grainstone of facies C is a maximum of 18% and consists of vuggy, intergranular, and intercrystalline pores. The upward transition from limestone to secondary dolomite commonly occurs in the lower part of facies C. The thickness of facies C ranges from 35 to 75 m (115 to 250 ft) and is inversely proportional to the thickness of the intertonguing and overlying facies B.

The uppermost two facies, termed B and A, reflect the upward transition from and open platform to a restricted platform environment. Facies B ranges in thickness from 25 to 75 m (80 to 250 ft) and is a nonporous, dolomitized mudstone and wackestone sequence generally containing some 1 m (3 ft) interbeds of porous dolomitized grainstone. This sequence is capped by < 10 m (30 ft) of intertidal rocks of facies A, which are thin-bedded, partly algally laminated, dense dolomites.

Locally, facies A and parts of B have been removed as a result of pre-Jurassic folding and erosion in the Sawtooth Range. However, all lateral thickness changes in facies C reflect its intertonguing with B. Although original facies patterns are greatly telescoped by thrusting, the porous grainstones of facies C are best developed in the vicinity of Blackleaf Canyon, Montana, the site of a recently developed commercial gas field in dolomite of the Madison Group.

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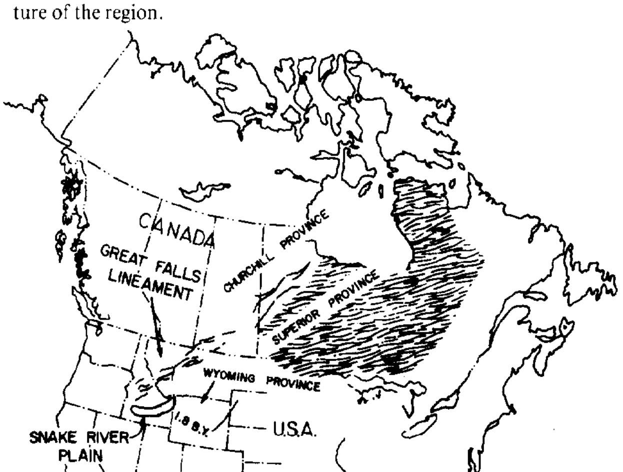
Great Falls Lineament, Idaho and Montana

The name "Great Falls lineament" is given to a northeast-trending zone of diverse geologic features that can be traced northeastward from the Idaho batholith in the Cordilleran miogeocline of the United States, across thrust belt structures and basement rocks of west-central and southwestern Montana, through the cratonic rocks of central Montana, and into southwesternmost Saskatchewan, Canada. The zone is well represented in east-central Idaho and west-central Montana where geologic mapping has outlined northeast-trending, high-angle faults and shear zones that: (1) extend more than 150 km (93 mi) from near Salmon, Idaho, northeastward toward Anaconda, Montana; (2) define a nearly continuous zone of faulting that shows recurrent movement from middle Proterozoic to Holocene time; (3) controlled the intrusion and orientation of some Late Cretaceous to early Tertiary batholithic rocks and early Tertiary dike swarms; and (4) controlled the uplift and orientation of the Anaconda-Pintlar Range. Recurrent movement along these faults and their strong structural control over igneous intrusions in this region suggest that northeast-trending faults represent a fundamental tectonic feature of the region.



Geologic features that are similar to those mapped in the Salmon-Anaconda region are present to the southwest and the northeast. In central Idaho, these structures include numerous northeast-trending faults and pronounced topographic lineaments that cut across the southern part of the Idaho batholith, and a northeast alignment of Tertiary igneous rocks that cut the Idaho batholith and adjacent rocks. East and southeast of the Anaconda-Pintlar Range, subparallel, high-angle faults and topographic lineaments are present in the Highland, Pioneer, Ruby, and Tobacco Root Mountains. High-angle faults may have in part controlled the orientation of the northeast-elongate Boulder batholith. Northeast-trending structures are not easily traced across the thrust belt of western Montana or across the Lewis and Clark line. In the central Montana plains, northeast of the disturbed belt, however, a broad zone of colinear, northeast-trending structures is present, and includes: parallel, buried basement highs that in part controlled depositional patterns of some Paleozoic and Mesozoic sedimentary rocks; major physiographic features, such as the remarkably straight, 175-km (109-mi) long segment of the Missouri River, and equally long, buried river channels in southwestern Saskatchewan; a northeasterly alignment of highly differentiated igneous rocks and a belt of ultrabasic intrusions and related diatremes;