complexes of northeastern Washington and northern Idaho.

Regional cross sections show no serious obstacles to the presence of an autochthonous or detached slab of Paleozoic rocks beneath the overthrust Belt section, although subhorizontal mylonitic rocks are not outside the realm of geologic possibility. Nevertheless, oil and gas favorability beneath Belt rocks is affected by such factors as ratio of source rock to reservoir rock, thermal and/or pressure conditions after overthrusting, and the postmigrational effects of Eocene extensional tectonism (i.e., dip reversals, magmatism, and fragmentation).

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Geometry and Mechanical Development of Heart Mountain Thrust Stack, Exshaw, Alberta

Heart Mountain is located near Exshaw, Alberta, and forms a peculiar localized thrust stack along the otherwise relatively linear Exshaw thrust trace in the Canadian front ranges. Data from stratigraphic and structural mapping on a scale of 1:5,000 were used in the construction of balanced cross sections, longitudinal sections, and stratigraphic separation diagrams to reveal the true three-dimensional geometry of the mountain. The structure (the "heart") is composed of a gently south-plunging canoe-shaped body of rock. Near its southern termination, however, the heart plunges steeply northward.

Several previously unrecognized features of the Heart Mountain structure were discovered during mapping. The heart is a faulted syncline with its east limb thrust up relative to its west limb. The heart's "collar" is composed of the Loomis Member of the Mississippian Mount Head Formation, not the Mississippian Livingstone Formation as previously mapped. The panel of Livingstone rocks west of the heart is stratigraphically up to the east.

Based on both stratigraphic and structural considerations, the thrust stack formed in an east-to-west sequential development from rock panels of relatively local origin. Mechanical considerations of the mountain's east-to-west sequential development require the location of the Exshaw thrust to be along the eastern margin of the structure. The Heart Mountain thrust stack, therefore, formed in the hanging wall of the Exshaw thrust.

Hydrocarbons have been found in structural traps similar to Heart Mountain. Understanding the geometry and order of mechanical development of these traps is essential to profitable exploration ventures.

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Landsat and Field Studies Link Structural Lineaments and Mineralization in St. Francois Mountains, Missouri

Late-stage Precambrian granites in the St. Francois Mountains are among the most uraniferous in North America. The St. Francois province has potential for uranium mineralization of economic importance, especially in the later differentiates.

Structural lineaments and circular features displayed on images produced by electronic data processing of Landsat multispectral scanner data may be related to late-stage intrusives with uranium potential. Strong north-south lineaments and associated circular and arcuate features may correspond to major weaknesses in the earth's crust along which fracturing, faulting, and volcanism have occurred. The strike of the lineaments transects the older dominant northwest-southeast and northeast-southwest structural grain of the region. This, and the remarkable preservation of Precambrian structures of volcanic origin, indicate that the lineaments may be related to late-stage, uranium- and thorium-rich intrusives. The Ironton lineament, a major north-south lineament, is closely related spatially to Precambrian iron and manganese deposits.

Field work along the Ironton lineament suggests that it is related to a late period of Precambrian volcanism and that structural deformation along the lineament continued into early Paleozoic time. Areas of faulting, shearing, and hydrothermal alteration affecting both Precambrian and Paleozoic rocks have been located. A circular feature along the lineament has been found to be centered by a manganese deposit of possible hydrothermal origin.

RUSSON, MIKE, Brigham Young Univ., Provo, UT

Stratigraphy and Economic Potential of Castle Gate Area, Carbon County, Utah

Unexcelled exposures of the coal-bearing Blackhawk Formation near Castle Gate, Utah, provide a cross section of sediments deposited by wave-dominated deltas along the western shoreline of the Cretaceous Interior seaway. Four sandstone tongues resulted from deltaic sedimentation, each overlain by thick coal. A clear genetic relationship exists between the occurrence of coal and geometries of paleoshorelines and fluvial channels. Coals are thickest where underlain by thin shoreface sandstones, and they pinch out abruptly against beach-ridge sandstones responsible for swamp proliferation. Fluvial channels subsequently cut wide swaths in swamp deposits normal to shoreline trends. Commonly, thick coals of different seams occur together, as the compaction of vegetation controlled subsequent swamp accumulation. Excellent exposures and considerable subsurface data provide the details necessary to construct a predictive exploration model useful in the Cretaceous coals of the central Rockies. Cretaceous deltaic deposits also create hydrocarbon potential, as three facies associated with Blackhawk deposition produce ideal stratigraphic relationships for hydrocarbon accumulation. Porous delta-front sandstones interfinger with the underlying organic-rich marine shale of the Mancos formation. Shale and siltstone of the flood plain then cap the sandstone. Hydrocarbons derived from the marine shale or from associated coal may accumulate in porous sands of stream channels or in mouth-bar or beach-ridge deposits of the delta front. A clear understanding of deltaic sedimentation, provided by analysis of the Blackhawk model, could aid in predicting the occurrences of similar subsurface sandstones.

SALES, JOHN K., Mobil Oil Corp., Dallas, TX

Heart Mountain, Wyoming—Blocks in a Collapsing Volcanic Pile

The Heart Mountain "detachment" was caused by volcanic collapse and not free sliding. These huge blocks could hang together if immersed in volcanics, but not in air. Block separation is logical during sideward volcanic collapse, but inertia and the rate required make free sliding untenable. Lack of erosion of the fault surface requires instant burial if free sliding was the cause. However, if the detachment was part of a volcanic collapse, the fault surface was never exposed. Free-moving blocks would gouge the delicate Grove Creek pavement, but the equal loading by a glacier-like collapse of volcanics would allow this stratigraphy to remain intact. Nothing in present experience moves free blocks on so large a scale on that flat a surface, especially up and over a transgressive ramp in a free setting. A collapsing volcanic pile propelled by its profile of repose, not by the slope under it, would allow movement. Earthquake vibration is ineffective in a free slide, but extremely effective in collapsing a weak pile. The Reef Creek structure is an imbrication; the South Fork is an unloading bulge. A long dip slope with a basin-facing monocline below it, a large young volcanic pile, seismicity, a swampy toe, and artesian pressure combined to cause failure. It may have been steady-state, incremental, or catastrophic, the latter being favored.

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Collapse of Rocky Mountain Basement Uplifts

Several Rocky Mountain uplifts have collapsed, usually back down the root zone of the thrust that raised the buckled slabs. Basement is juxtaposed against sedimentary fills and subcrust is juxtaposed against granitic crust. Thus, uplifts have "anti-roots" and strong positive gravity anomalies with slabs held up by strength rather than buoyancy, making them susceptible to collapse. The Rio Grande rift trends along the crests of older uplifts. Collapse is accentuated by regional uplift that removes basin fills. This substitution of "air for rock" increased gravity stressing.

Large gravity faults, including the San Luis basin boundary fault with relief that may exceed 20,000 ft (6,100 m), are caused by this mechanism. Their large size may be caused by a significant increment of displacement above the isostatic equilibrium position added to the normal buoyancy mechanism that drives these faults.

The north side of the Brown's Park graben in the Uinta Mountains