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Effects of Overthrusting on Triassic Shelf Strata, East Range, Nevada

Triassic shelf strata exposed in the East Range of north-central Nevada are overthrust from east to west by lower Paleozoic rocks, originally of the Roberts Mountain allochthon, and overthrust from west to east, along the Fencemaker thrust, by imbricated basinal turbidites and related deposits dated as Norian. Analysis of fabric elements of the shelf rocks indicates that early deformation was west verging, affirming an affinity to the predominantly west-verging Winnemucca fold and thrust belt.

Autochthonous or para-autochthonous shelf rocks consist of deltaic and carbonate platform deposits deformed in sequential fold sets: first in tight to isoclinal, reclined, west-verging folds of thin beds with axial-plane cleavage; then in major and minor, close, west-verging folds of beds and first cleavage, with formation of a second axial plane cleavage. First- and second-phase folds are transected by the Fencemaker thrust, which could be contemporaneous or later than shelf folding.

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Little Known Mid-Paleozoic Salts of Northwestern North Dakota

Four Paleozoic formations that contain bedded salts previously undescribed in North Dakota have been identified and mapped. They are the Silurian Interlake, and Devonian Ashern, Souris River, and Duperow Formations.

A series of stratigraphically and areally discontinuous, thin, bedded salts has been identified in the Silurian Interlake Formation. As many as five, thin, bedded salts are present in the upper gray member of the Devonina Ashern Formation. Where found, these salts are stratigraphically correlatable but laterally discontinuous. A thin, bedded salt is present in both the Souris River and Duperow. These salts are laterally continuous with salts previously described in Saskatchewan.

Although the occurrences of the salts discussed commonly are discontinuous, knowledge of their presence can be helpful in designing a drilling and testing program for wells in areas where they occur. Furthermore, a knowledge of the presence of these salts is helpful in understanding the overall tectonic and depositional history of the Williston basin.

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Alteration of Magnetite and Ilmenite in Upper Jurassic Morrison Formation, San Juan Basin, New Mexico: Relationship to Facies and Primary Uranium Mineralization

Petrographic studies of outcrop and drill core samples in the Westwater Canyon Member of the Morrison Formation along the southern and western margins of the San Juan basin reveal a close spatial relationship among altered (iron-leached) detrital magnetite and ilmenite (FeTi oxides), depositional facies in the overlying Brushy Basin Member, and distribution of primary uranium deposits. Iron leaching of FeTi oxides resulted from passage of solutions containing soluble organic material; concentrations of this organic material are the sites of the primary uranium orebodies. Along the southern and western parts of the basin, FeTi oxides typically have been leached in the upper Westwater Member, but are unaltered in the lower Westwater; however, locally, leaching occurred throughout the Westwater. This zone of leaching systematically thins northward to zero, where unleached FeTi oxides occur throughout the Westwater.

Regional patterns of alteration of FeTi oxides correspond to regional facies distribution in the overlying Brushy Basin Member. Extensive FeTi oxide leaching characterizes the Westwater beneath the smectite-rich mud-flat facies of the Brushy Basin, whereas negligible leaching characterizes the Westwater beneath the zeolite-rich playa facies of the Brushy Basin. This correspondence between facies and alteration patterns suggests that solutions responsible for solubilization of organic material, which in turn leached FeTi oxides in the Westwater, originated from the mud-flat facies of the Brushy Basin. Organic material that precipitated from these solutions concentrated uranium to form primary uranium orebodies; therefore, distribution of the Brushy Basin mud-flat facies may define, and restrict, distribution of primary orebodies in the Westwater.

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Comparison of Landsat Multispectral Scanner and Thematic Mapper Data from Wind River Basin, Wyoming

Landsat Multispectral Scanner (MSS) data are limited by MSS spatial resolution (80 m or 262 ft) and bandwidth selection. Landsat 4 Thematic Mapper (TM) data have greatly enhanced spatial resolution (30 m or 98 ft) and TM operates in spectral bands suited to geologic interpretation. To compare the two systems, three images centered over the Wind River basin of Wyoming were obtained. Two were TM images—a false color composite (FCC) and a natural color composite (NCC)—and the third was an MSS image.

A systematic analysis of drainage, landforms, geologic structure, gross lithologic characteristics, lineaments, and curvilinears was performed on the three images. Drainage density and landform distinction were greatly enhanced on the TM images. Geologic features such as faults, strike and dip, folds, and lithologic characteristics are often difficult to distinguish on the MSS image but are readily apparent on the TM images. The lineament-curvilinear analysis of the MSS image showed longer but less distinct linear features. In comparison, the TM images allowed interpretation of shorter but more distinct linear elements, providing a more accurate delineation of the actual dimensions of the geologic features which these lineaments are thought to represent. An analysis of the oil production present in the study area showed 75% of the surface productive structures were delineated on the TM images, whereas only the most obvious structures were visible on the MSS image.

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Maturation History and Thermal Evolution of Cretaceous Source Rocks of Bighorn Basin, Wyoming and Montana

The Laramide basins of the Rocky Mountain region are deep asymmetric structural depressions containing thick sequences of Upper Cretaceous and Tertiary sandstone strata. The combined effects of tectonics and sedimentation have contributed to the thermal evolution of the basins and to the maturation history of the source rocks. In the Bighorn basin of Wyoming and Montana, total organic carbon (TOC) values for samples from a 2,000-ft (610-m) thick interval, including the Thermopolis, Mowry, Frontier, and Cody Formations, average 1 wt. %. The hydrogen indices and elemental analyses suggest that most of the samples presently contain kerogen between types II and III. The genetic potential of these samples suggests that they are moderately good source rocks. Vitrinite reflectance values, production indices, elemental analyses, and the distribution of extractable hydrocarbons suggest that these Cretaceous source rocks can be within the liquid hydrocarbon window from a present day depth of 2,000-3,000 ft (610-914 m) down to 11,000-12,000 ft (3,353-3,658 m).

On the basis of these observations, plus graphical and numerical thermal models for the Bighorn basin, it is suggested that (1) the Cretaceous section has generated hydrocarbons and could have produced the hydrocarbon production in the Bighorn basin, particularly from Cretaceous reservoirs, (2) migration distances for hydrocarbons into Cretaceous reservoirs could be short, (3) the stratigraphic and lateral distribution of marine sandstones intercalated within the Cretaceous source rocks provide ample opportunity for stratigraphic and/or diagenetic traps over a wide depth interval in this basin, and (4) owing to variations in thermal gradients within this basin, or similar Laramide-type basins, the hydrocarbon liquid window is expanded over a particular stratigraphic interval with depth.