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**Tectonic Setting and Paleogeography of Permian and Pennsylvanian Rocks in Wyoming and Adjacent States**

Pennsylvanian and Permian rocks of the Wyoming shelf in the northern Rocky Mountains and adjacent western Great Plains record an initial major epeirogenic event and subsequent diminishing tectonic movements. Underlying Mississippian rocks in the region were deposited on a stable shelf and are composed mainly of a wedge of carbonate sediments that thickens from the Transcontinental Arch and the Canadian Shield to the outer shelf margin adjacent to the Cordilleran geosyncline. Pennsylvanian sedimentation was initiated after termination of Mississippian deposition by differential uplift of the Wyoming shelf and the accompanying withdrawal of the epicontinental sea. The uplift was part of a major epeirogenic event in the Western Interior and may have been a local tectonic expression of the Alleghenian orogeny. During this epeirogeny, the northern and northwestern margins of the Wyoming shelf were sharply defined in Montana by the Musselshell and the Greenhorn lineaments, which separated the shelf from the Big Snowy and Snowcrest troughs. The Beartooth platform, a part of the Wyoming shelf adjacent to the Greenhorn and Musselshell lineaments, had little topographic relief and sloped gently southeastward into the Sweetwater trough of south-central Wyoming. This trough trended northeastward from the Uinta Mountains in northern Utah at least to the vicinity of Casper in east-central Wyoming. Southeast of the Sweetwater trough, several northwest-trending ancestral Rocky Mountain uplifts, notably including the ancestral Front Range, were elevated in Colorado and southeastern Wyoming on the northwestern flank of the Transcontinental Arch.

The earliest Pennsylvanian deposits in most of Wyoming, according to Mallory (1975) and Maughan (*in* Lageson and others, 1979), are red beds composed of supratidal(?) and intertidal sediments and overlying shallow littoral limestone beds within the Amsden Formation of northwestern Wyoming, similar rocks in the lower members of the Casper, Hartville, and Minnelusa Formations of eastern Wyoming, and in the Round Valley Limestone of southwestern Wyoming. These sediments were deposited after the Pennsylvanian sea had first inundated the troughs and then spread over the intervening uplands between the troughs. These peritidal and shallow littoral deposits intertongue in south-central Wyoming with the arkosic sediments of the Fountain Formation, which were shed from the ancestral Rocky Mountains. Middle Pennsylvanian tectonism on the Wyoming shelf caused faulting or folding, erosion in uplifted areas of Amsden and other lower Pennsylvanian

rocks and older rocks, and initiated the widespread deposition of quartzose sand. Sandy beds of the Tensleep, Weber, and Wells Formations, and the middle members of the Casper, Hartville, and Minnelusa, were deposited as a thin blanket in shallow marine and eolian environments during Middle Pennsylvanian. However, age-equivalent strata are much thicker in the Oquirrh basin of the foreland and in the troughs associated with the shelf. Deposition seems to have continued in subsiding intercratonic basins and troughs during the Late Pennsylvanian, but sediments of that age either were not deposited or were subsequently eroded at many places on the Wyoming shelf.

The disconformable contact of Pennsylvanian and Permian strata of the Wyoming shelf represents a major hiatus. Rejuvenation of the ancestral Rocky Mountains, the formation of the Wyoming arch, and probable initial elevation of the Milk River uplift in central Montana occurred during Late Pennsylvanian and Early Permian time. Permian sediments lapped onto these uplifts toward central Wyoming as the epicontinental sea inundated the shelf from the southeast and from the west. Initial Permian sediments in southeastern Wyoming comprise a lateritic regolith, the "red marker," that had formed on the Pennsylvanian rocks prior to the late Wolfcampian inundation and the subsequent deposition of the upper members of the Casper, Hartville, and Minnelusa. Strata of Early Permian age occur also in the upper part of the Wells Formation, and possibly are included in the Grandeur Member of the Park City Formation and the upper part of the Weber Sandstone in western and southwestern Wyoming. The Tensleep and laterally equivalent sandstone units were elevated and eroded along the Wyoming arch and the associated uplifts, which were the provenance for much of the Lower Permian dune sand in the Casper, Hartville, Minnelusa, Ingleside, and Weber Formations. Wolfcampian to Leonardian uplift of most of Wyoming restricted deposition of the Leonardian lower part of the Satanka Formation in Wyoming (Owl Canyon Formation in Colorado, or Cassa Group of Nebraska, of Condra, Reed, and Scherer, 1940), to the southeastward of Blackstone's Wyoming lineament (Maughan, 1983). Equivalent Leonardian age rocks are unknown elsewhere in Wyoming, with the possible exception of the sand dunes commonly assigned to the uppermost part of the Minnelusa Formation along the Belle Fourche arch in northeastern Wyoming.

The Sublette basin subsided markedly at the western edge of the North American craton in mid-Permian time. The sea deepened at the western edge of Wyoming, but there seems to have been only minor epeirogenic subsidence on the inner shelf in central and eastern Wyoming. The youngest sequence of Permian beds in the Phosphoria, Park City, and Goose Egg Formations was deposited while the depth of the Cordilleran sea increased in the basin and the marine waters transgressed eastward to shallowly inundate the shelf. Carbonaceous mudstone, phosphorite, and chert of the Phosphoria Formation were deposited on the basin slope in western Wyoming at the same time as carbonate

bank sediments of the Park City Formation were deposited along the adjacent part of the shelf in a westerly concave arc in northwestern, central, and southwestern Wyoming. Intertidal and possibly supratidal red mudstone and evaporite beds were deposited on a restricted inner part of the shelf east of the Wyoming arch during late Leonardian (Roadian) and early Guadalupian time. Depocenters and shorelines of these mid-Permian sediments were shifted northwestward at about the beginning of the Guadalupian by a minor tectonic pulse that may have been caused by a slight regional tilting of the Wyoming shelf. Rocks of late Guadalupian and Ochoan age are absent in Wyoming, but Lower Triassic rocks of the Dinwoody Formation in western Wyoming and age-equivalent strata of the upper members of the Goose Egg Formation in eastern Wyoming are paraconformable with uppermost Permian strata. The paraconformity indicates prolonged non-deposition and a period of exceptional tectonic stability of the Wyoming shelf that continued through the Triassic.