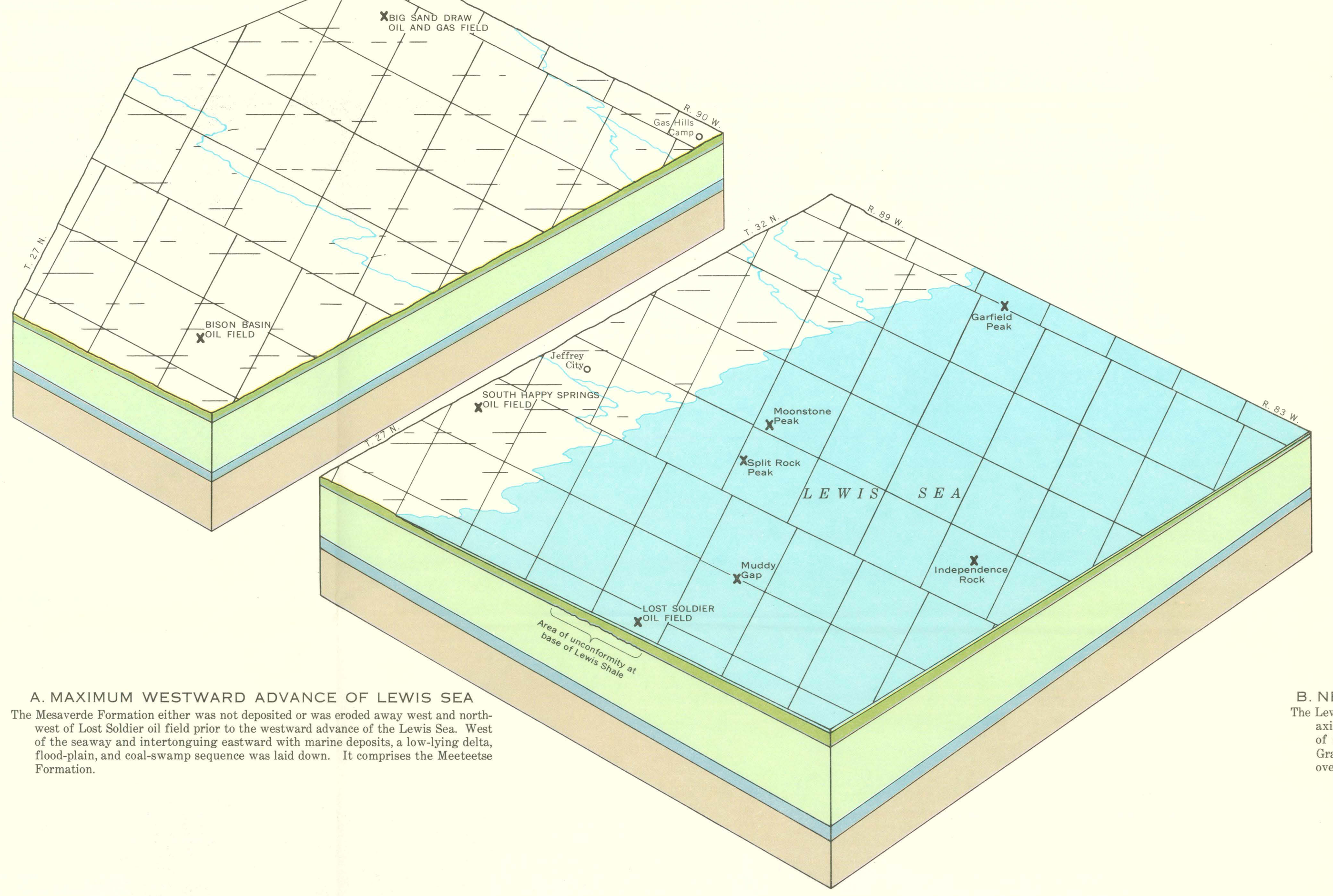
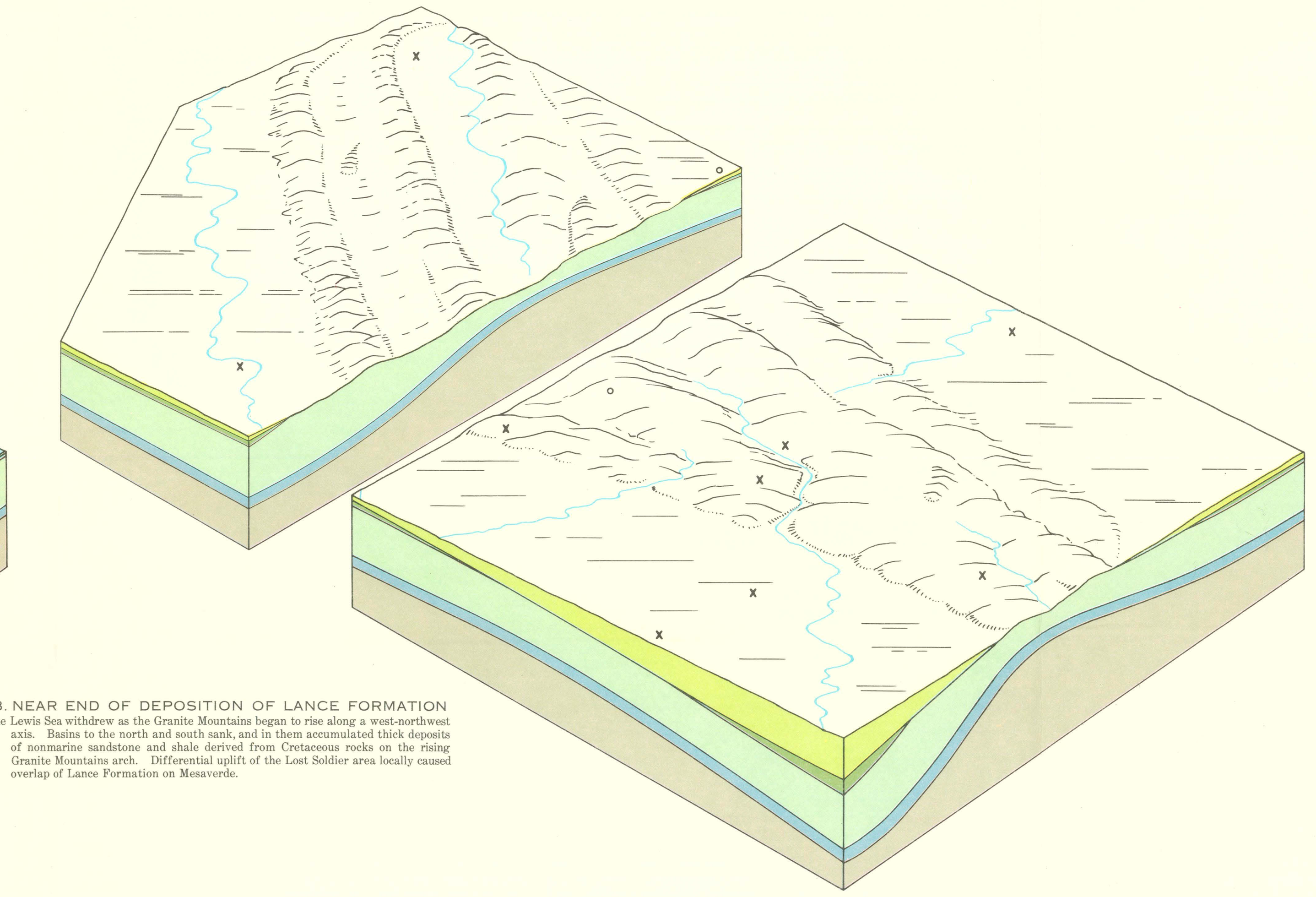
PREPARED IN COOPERATION WITH THE
GEOLOGICAL SURVEY OF WYOMING AND THE
DEPARTMENT OF GEOLOGY OF THE UNIVERSITY OF WYOMING
AS PART OF A PROGRAM OF THE
DEPARTMENT OF THE INTERIOR FOR THE DEVELOPMENT OF THE MISSOURI RIVER BASIN



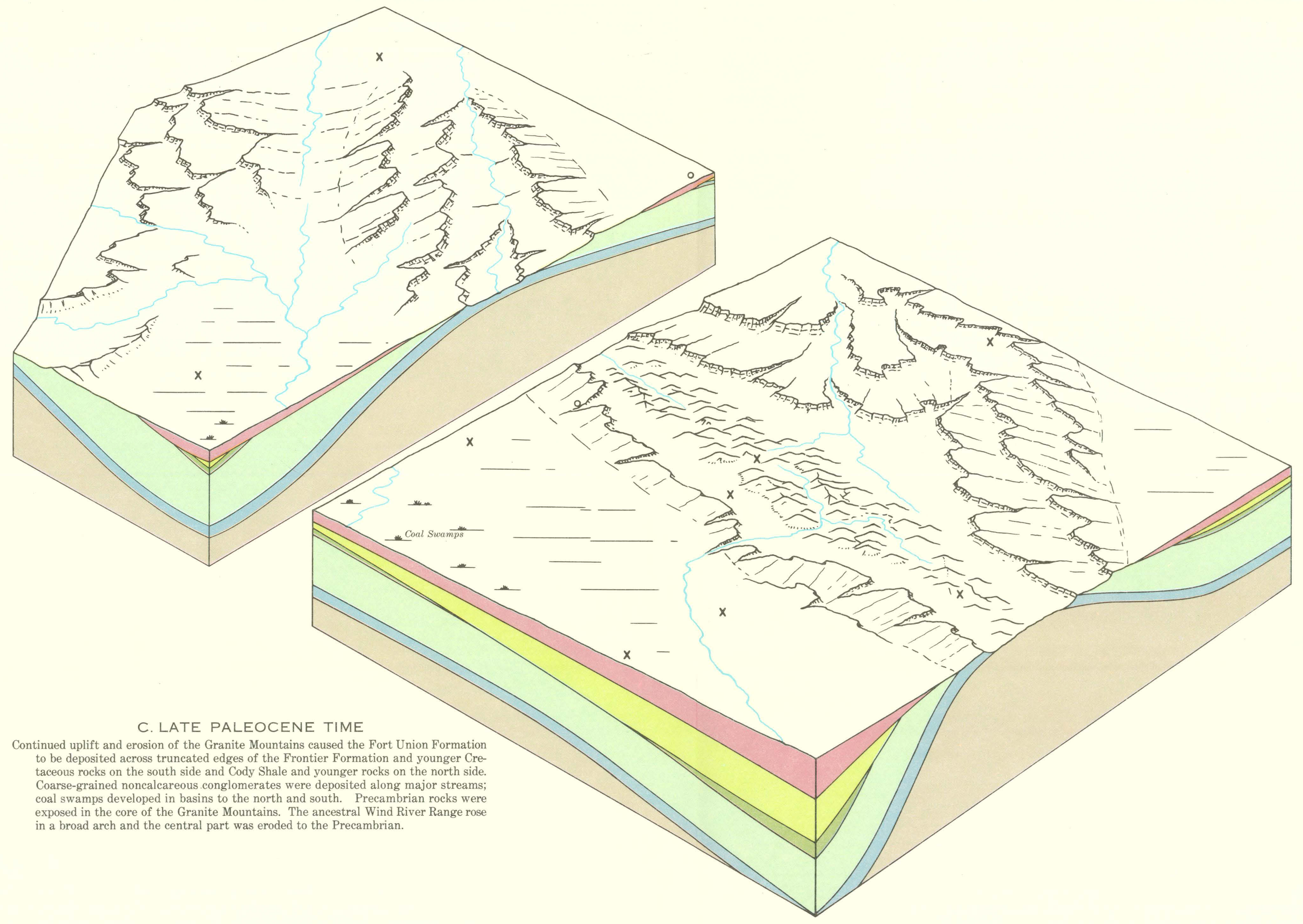
A. MAXIMUM WESTWARD ADVANCE OF LEWIS SEA

The Mesaverde Formation either was not deposited or was eroded away west and northwest of Lost Soldier oil field prior to the westward advance of the Lewis Sea. West of the seaway and intertonguing eastward with marine deposits, a low-lying delta, flood-plain, and coal-swamp sequence was laid down. It comprises the Meeteetse Formation.



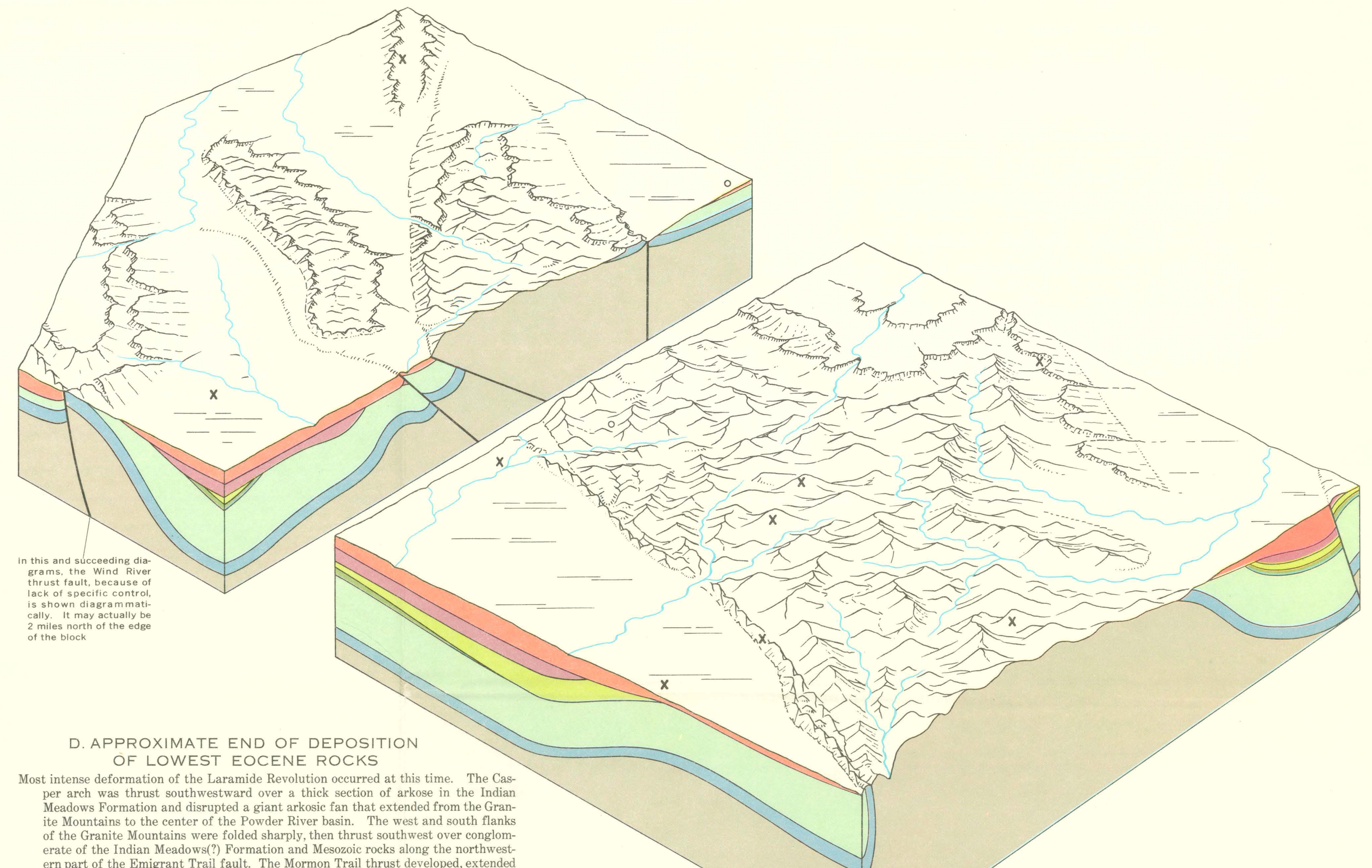
B. NEAR END OF DEPOSITION OF LANCE FORMATION

The Lewis Sea withdrew as the Granite Mountains began to rise along a west-northwest axis. Basins to the north and south sank, and in them accumulated thick deposits of nonmarine sandstone and shale derived from Cretaceous rocks on the rising Granite Mountains arch. Differential uplift of the Lost Soldier area locally caused overlap of Lance Formation on Mesaverde.



C. LATE PALEOCENE TIME

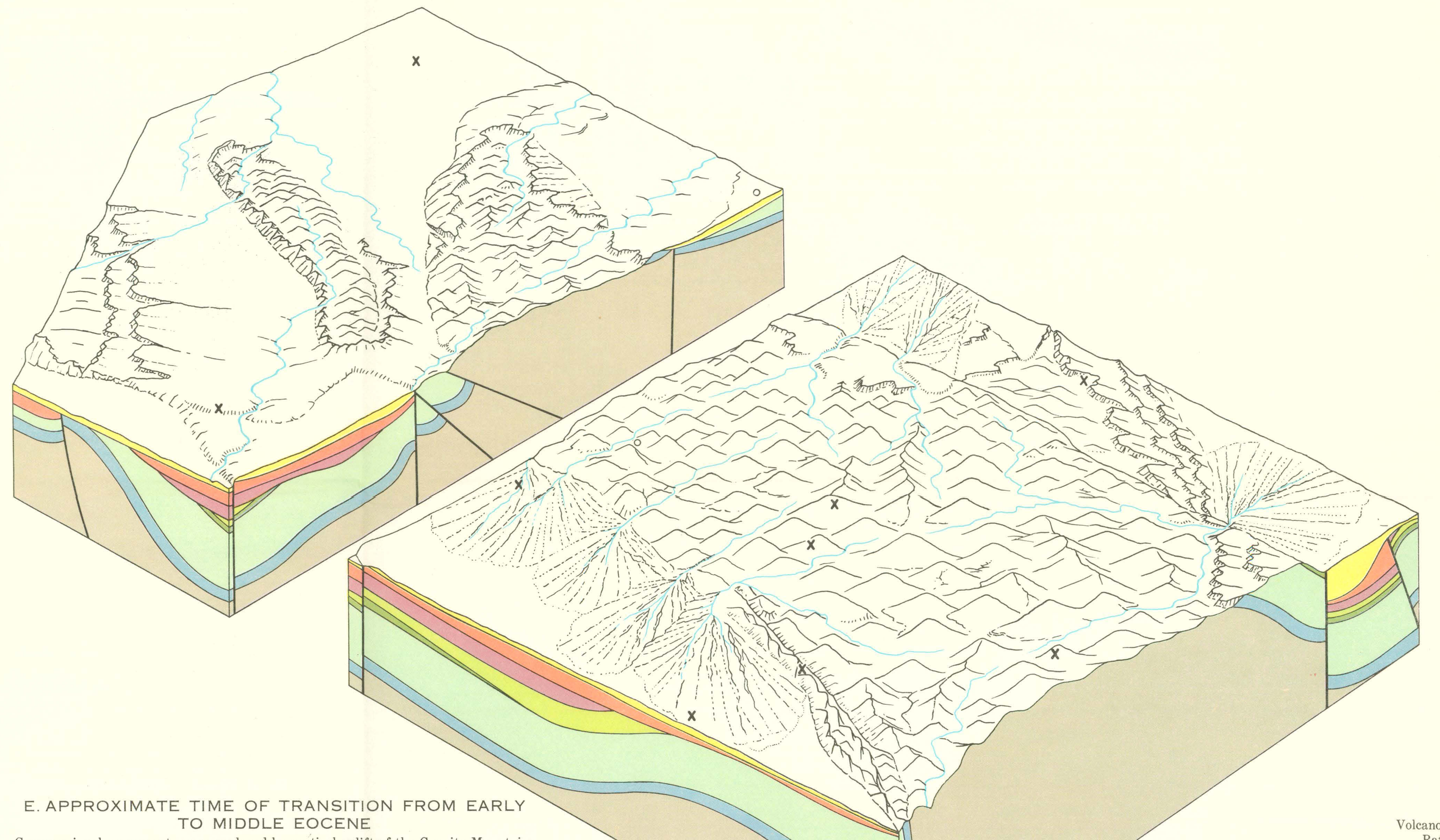
Continued uplift and erosion of the Granite Mountains caused the Fort Union Formation to be deposited across truncated edges of the Frontier Formation and younger Cretaceous rocks on the south side and Cody Shale and younger rocks on the north side. Coarse-grained noncalcareous conglomerates were deposited along major streams; coal swamps developed in basins to the north and south. Precambrian rocks were exposed in the core of the Granite Mountains. The ancestral Wind River Range rose in a broad arch and the central part was eroded to the Precambrian.



In this and succeeding diagrams, the Wind River thrust fault, because of lack of specific control, is shown diagrammatically. It may actually be 2 miles north of the edge of the block

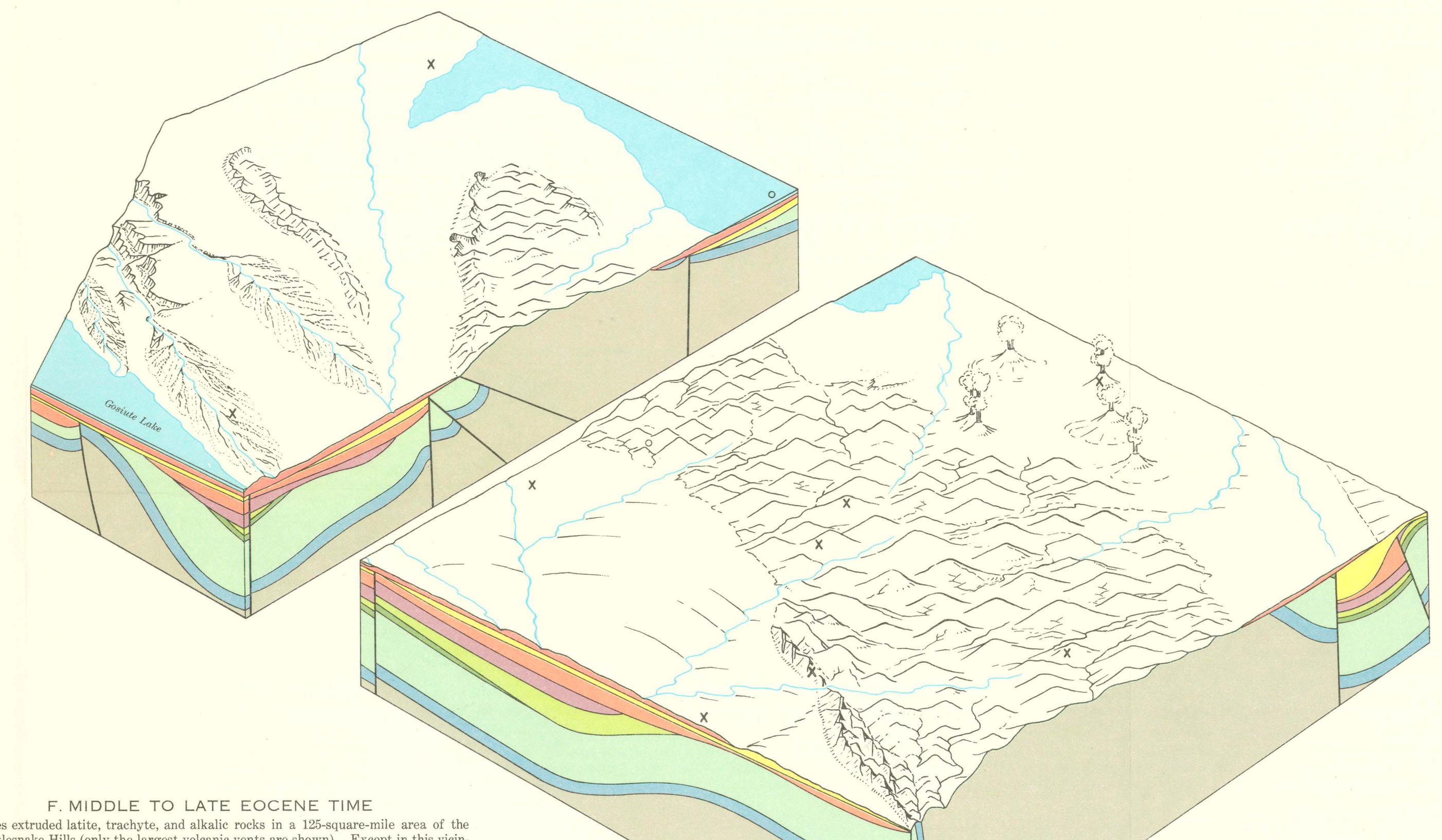
D. APPROXIMATE END OF DEPOSITION OF LOWEST EOCENE ROCKS

Most intense deformation of the Laramide Revolution occurred at this time. The Casper arch was thrust southwestward over a thick section of arkose in the Indian Meadows Formation and disrupted a giant arkosic fan that extended from the Granite Mountains to the center of the Powder River basin. The west and south flanks of the Granite Mountains were folded sharply, then thrust southwest over conglomerate of the Indian Meadows(?) Formation and Mesozoic rocks along the northwestern part of the Emigrant Trail fault. The Mormon Trail thrust developed, extended west from Crooks Gap to the Wind River Range, and formed the structural north margin of the Great Divide basin. The Sweetwater Crossing anticline rose between the Granite Mountains and Wind River Range and was thrust southwest along the Beaver Creek fault. An enormous arkosic fan, a counterpart to the one on the north side, extended from the Granite Mountains south into the Great Divide basin and was overridden by Precambrian rocks along the southern part of the Emigrant Trail thrust. The Wind River Range rose and was thrust southwest over lowest Eocene and older rocks.



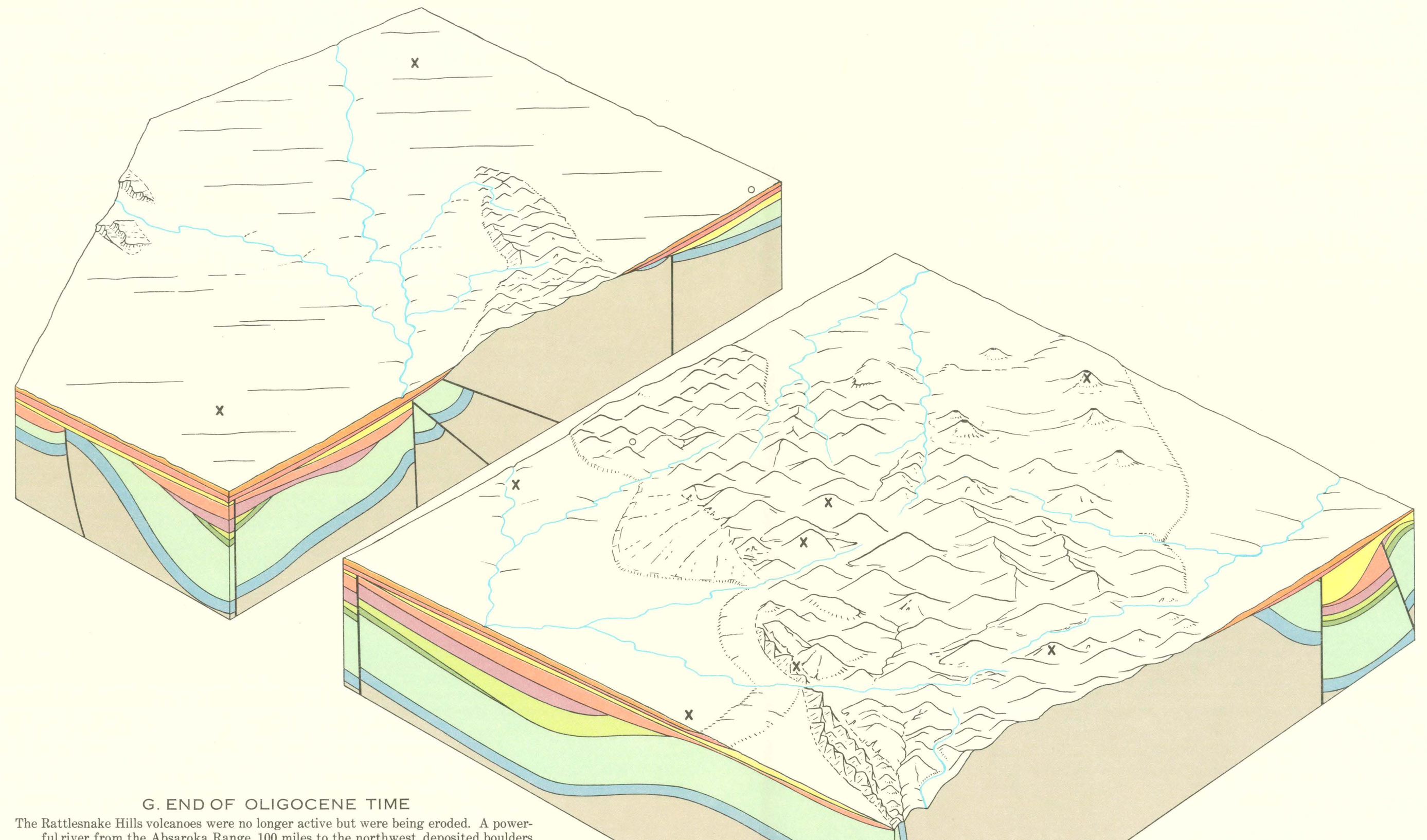
E. APPROXIMATE TIME OF TRANSITION FROM EARLY TO MIDDLE EOCENE

Compressional movements were replaced by vertical uplift of the Granite Mountains along the newly formed North and South Granite Mountains fault systems. As much as 5,000 feet of vertical displacement, accompanied by an equal amount of stripping of the rising block, occurred along the northeast margin of the range. About 3,000 feet of uplift and stripping took place along the south margin near Crooks Gap. The South Granite Mountains fault system parallels the Emigrant Trail thrust east of Crooks Gap and the Mormon Trail thrust to the west as far as the Soap Holes (A). The Flattop fault, up 1,000-2,500 feet on the north block, extended west from the Great Divide basin to the south margin of the Wind River Range. Because these broad mountain and intermontane uplifted areas either were sources of arkose or were already covered with it at the time of uplift, great fans of this material spread north into the Wind River basin and south into the Great Divide basin. Sporadic uplift along the Flattop fault caused extensive truncation of lower Eocene rocks and the Cathedral Bluffs Tongue of the Wasatch Formation prior to deposition of the Laney Shale Member of the Green River Formation.



F. MIDDLE TO LATE EOCENE TIME

Volcanoes extruded latite, trachyte, and alkalic rocks in a 125-square-mile area of the Rattlesnake Hills (only the largest volcanic vents are shown). Except in this vicinity, little crustal movement of importance occurred. There were major changes in drainage. For the first time the Wind River basin was filled with sediment, and streams from the Absaroka volcanic area flowed southeast along the west margin of the Granite Mountains and on into the Great Divide basin. East drainage from the Wind River basin was blocked and lakes of unknown size were impounded. Gosiute Lake, in which the Green River Formation was deposited, extended northward into the southwest corner of the area. Much airborne fine-grained volcanic debris from the Absaroka and Rattlesnake Hills areas was deposited on flood plains and in lakes. In late Eocene time an uplift in the Wind River Range destroyed Gosiute Lake and caused deposition of three fans of torrential boulder debris, chiefly of lower Paleozoic rocks. These spread southeastward into the Great Divide basin. Maximum thickness of middle and upper Eocene rocks in vicinity of Gosiute Lake not shown on diagram.



G. END OF OLIGOCENE TIME

The Rattlesnake Hills volcanoes were no longer active but were being eroded. A powerful river from the Absaroka Range, 100 miles to the northwest, deposited boulders of volcanic rocks and tuff, composing the Beaver Divide Conglomerate Member of the White River Formation, in a southeast-trending trough along the west margin of the Granite Mountains. Tributary streams from the Wind River Range and Granite Mountains brought arkosic debris that became progressively more dominant in a southeasterly direction. The White River Formation is chiefly massive gray tuffaceous siltstone with lesser amounts of claystone, sandstone, and conglomerate. Many conspicuous white, relatively pure pumicite beds represent ash falls, probably from volcanoes in the Absaroka Range. Only rocks of early Oligocene age remain in most of the area. Presumably younger strata lapped much higher on the Granite Mountains but were stripped off the entire southeast part of the mountain and basin area as the result of broad uplift in middle or late Oligocene time. This diagram does not portray original maximum extent of Oligocene rocks.

EXPLANATION

- Moonstone Formation
- Split Rock Formation
- White River Formation
- Upper and middle Eocene rocks
- Wind River Formation and approximate equivalents
- Rocks of earliest Eocene age
- Fort Union Formation

TERTIARY

- Lance Formation
- Lewis Shale and equivalent rocks

CRETACEOUS

- Pre-Lewis Mesozoic rocks
- Paleozoic rocks
- Precambrian rocks

Structure of pre-Tertiary rocks is generalized

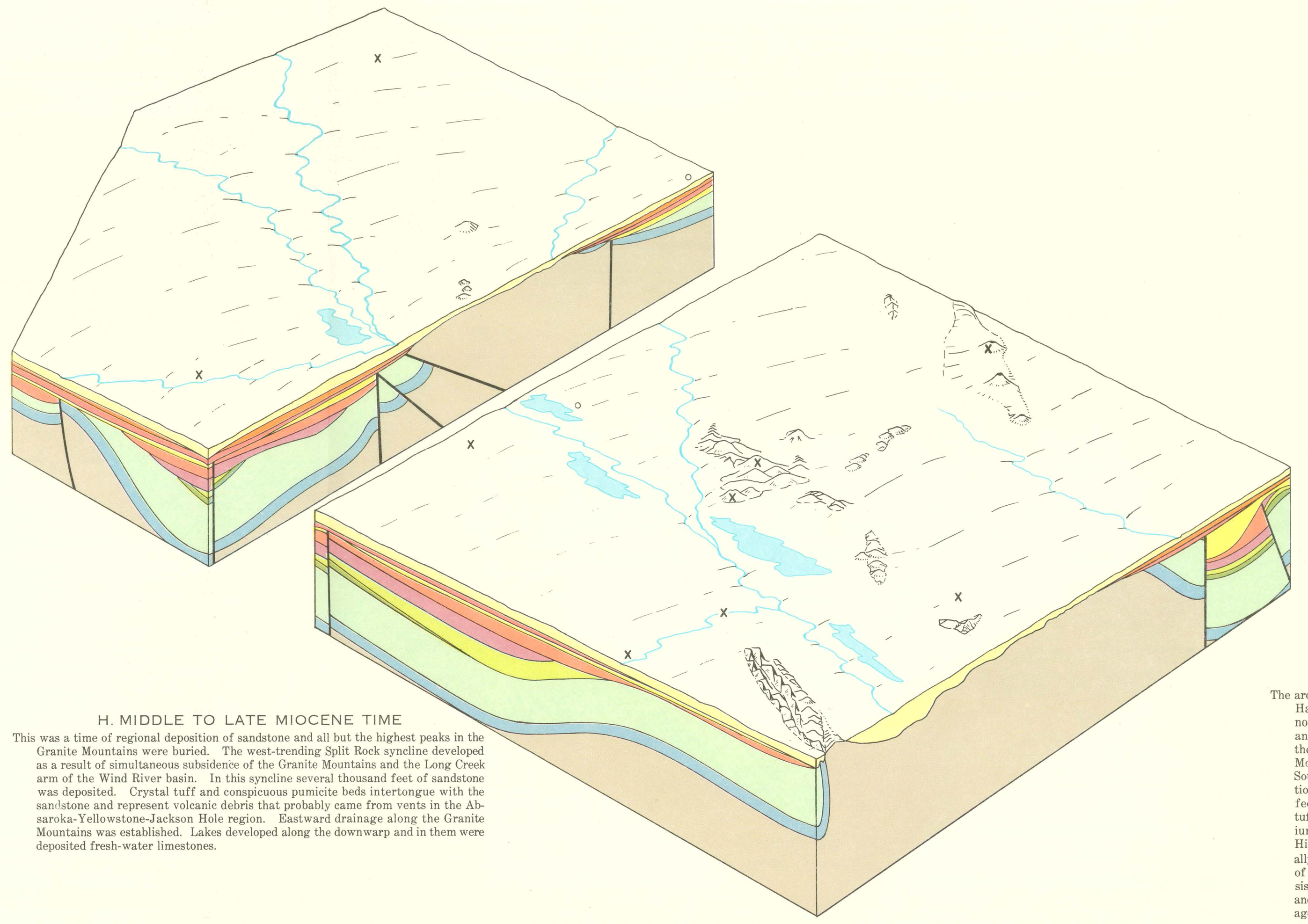
Features described are shown on the tectonic map

N

SCALE 1:500 000

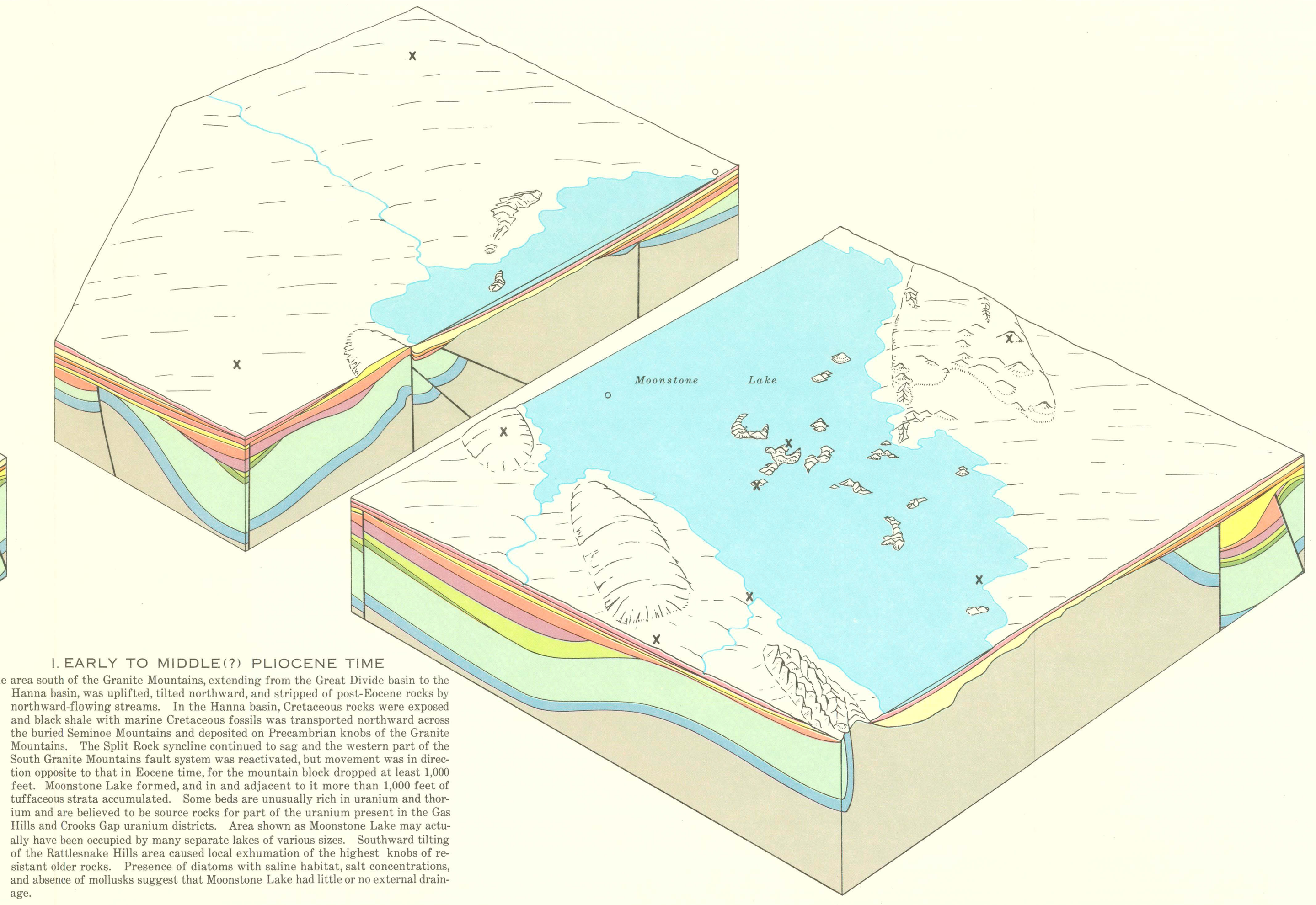
VERTICAL SCALE AT NEAREST CORNER OF BLOCK

VERTICAL EXAGGERATION AT NEAREST CORNER OF BLOCK



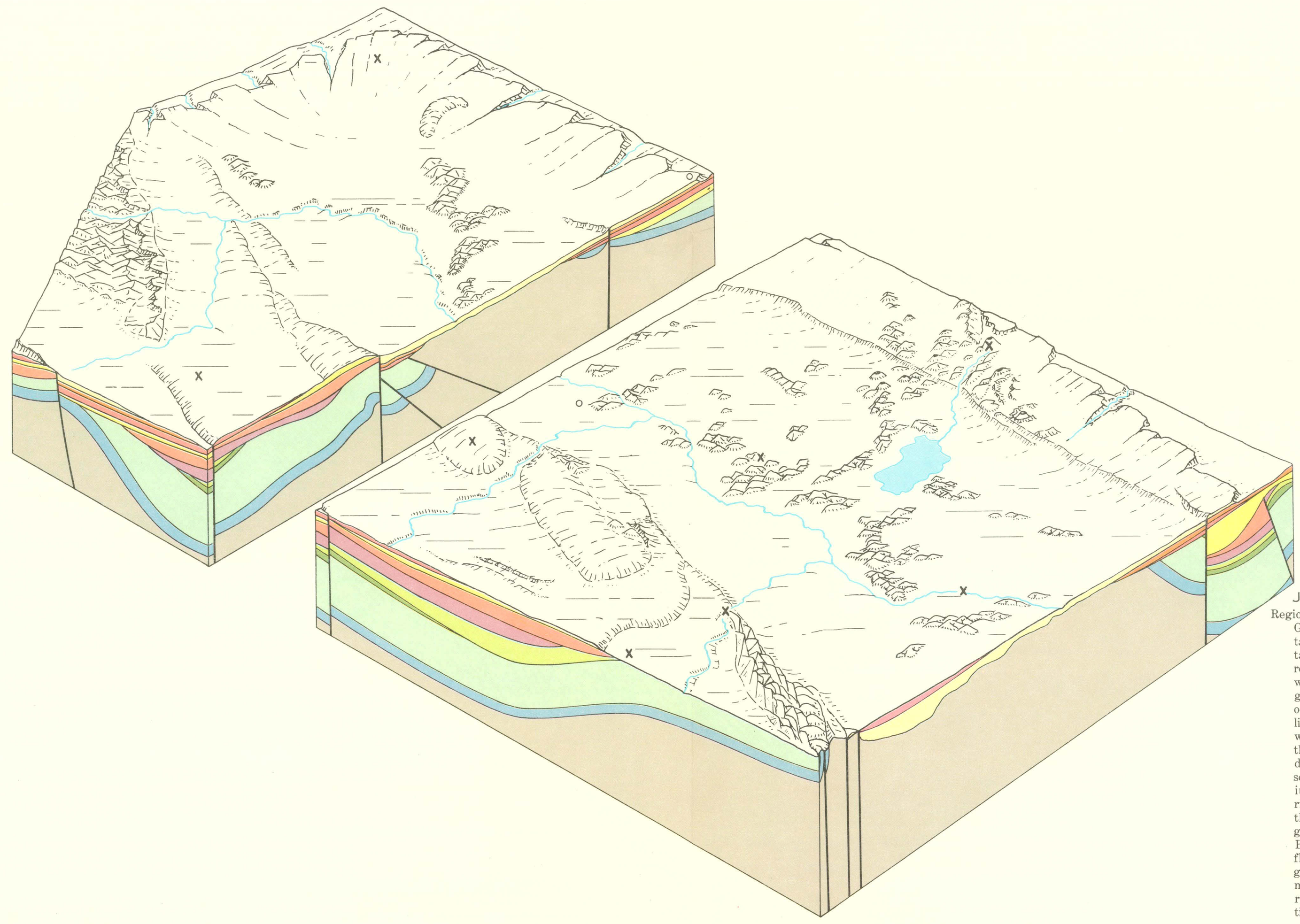
H. MIDDLE TO LATE MIOCENE TIME

This was a time of regional deposition of sandstone and all but the highest peaks in the Granite Mountains were buried. The west-trending Split Rock syncline developed as a result of simultaneous subsidence of the Granite Mountains and the Long Creek arm of the Wind River basin. In this syncline several thousand feet of sandstone was deposited. Crystal tuff and conspicuous pumicite beds intertongue with the sandstone and represent volcanic debris that probably came from vents in the Absaroka-Yellowstone-Jackson Hole region. Eastward drainage along the Granite Mountains was established. Lakes developed along the downwarp and in them were deposited fresh-water limestones.



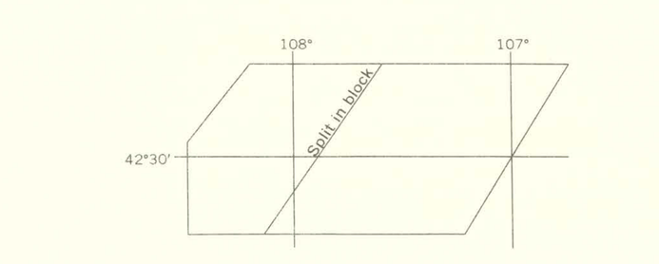
I. EARLY TO MIDDLE(?) PLIOCENE TIME

The area south of the Granite Mountains, extending from the Great Divide basin to the Hanna basin, was uplifted, tilted northward, and stripped of post-Eocene rocks by northward-flowing streams. In the Hanna basin, Cretaceous rocks were exposed and black shale with marine Cretaceous fossils was transported northward across the buried Seminoe Mountains and deposited on Precambrian knobs of the Granite Mountains. The Split Rock syncline continued to sag and the western part of the South Granite Mountains fault system was reactivated, but movement was in direction opposite to that in Eocene time, for the mountain block dropped at least 1,000 feet. Moonstone Lake formed, and in and adjacent to it more than 1,000 feet of tuffaceous strata accumulated. Some beds are unusually rich in uranium and thorium and are believed to be source rocks for part of the uranium present in the Gas Hills and Crooks Gap uranium districts. Area shown as Moonstone Lake may actually have been occupied by many separate lakes of various sizes. Southward tilting of the Rattlesnake Hills area caused local exhumation of the highest knobs of resistant older rocks. Presence of diatoms with saline habitat, salt concentrations, and absence of mollusks suggest that Moonstone Lake had little or no external drainage.



J. LATE PLIOCENE TO EARLY PLEISTOCENE TIME

Regional uplift started the present cycle of degradation in central Wyoming. In the Granite Mountains area, reactivation of movement along the North Granite Mountains fault system and more widespread movement along the South Granite Mountains fault system, both with the mountain block downdropped, locally reduced the regional effect of lowered base level. The easterly course of the Sweetwater River was established along the trough line of the Split Rock syncline but continued sagging of the Granite Mountains reduced the ability of this stream to erode. Thus, only 1,000 feet of the buried crest of the mountains was exhumed. As the trough line of the syncline migrated southward, north-flowing tributaries were not everywhere able to reach the river. Recurrent movment along the Flattop fault was in the same direction as that in Eocene time. The south end of the Wind River Range dropped along the Continental fault. At least one highly saline lake was present south of the Rattlesnake Hills, and in it accumulated thin beds of uranium- and thorium-rich limestone. The North Platte River cut an antecedent course across the rising Seminoe Mountains. A broad east-trending upwarp in the southern part of the Wind River basin caused northward diversion of Wind River and increased the gradient of its northward-flowing tributaries. This resulted in development of the Beaver Divide. In the Gas Hills uranium district, southward tilting of the south flank of this flexure reversed the northward downdip movement of uranium-charged ground water that previously had gone into the Wind River basin. The water now moved southward down the new dip and was trapped against faults and other barriers. Many of the uranium ore bodies were probably formed or modified at this time.



INDEX SHOWING LOCATION OF BLOCK DIAGRAM

MAPS OF GRANITE MOUNTAINS AREA, CENTRAL WYOMING, DURING SUCCESSIVE STAGES OF STRUCTURAL DEVELOPMENT

Geology by J. D. Love, 1965