DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE
WYOMING STATE ENGINEER
AND THE
WYOMING DEPARTMENT OF ECONOMIC PLANNING AND DEVELOPMENT

MISCELLANEOUS INVESTIGATIONS SERIES
MAP I-1308

METRIC CONVERSIONS

Multiply	By	To obtain
feet	0.3048	meters

EXPLANATION

- Qts — QUATERNARY TERRACE DEPOSITS—Shown only near Carpenter and Pine Bluffs
- To — MIOCENE OGALLALA FORMATION
- Ta — MIOCENE ARIKAREE FORMATION
- Tw — OLIGOCENE WHITE RIVER GROUP OR FORMATION
- Twa — SEQUENCE OF CONGLOMERATE TO MUDSTONE—Shown only in southeastern part
- CONTACT—Dashed where approximately located
- POTENTIOMETRIC SURFACE
- SATURATED PART OF OGALLALA FORMATION, AND WHITE RIVER GROUP OR FORMATION

PREPARATION OF THE FENCE DIAGRAM

This diagram is a pictorial representation of the distribution of the upper rock layers that underlie southeastern Wyoming and the adjacent part of Colorado. The diagram shows in three dimensions the water-yielding Quaternary terrace deposits and the Tertiary formations—the Ogallala Formation, Arikaree Formation, and White River Group (table 1)—in the area. The diagram is oriented principally in the east-west direction, with the north-south direction shown as forming a 60° angle with the east-west direction. With only one exception, the panels of the fence diagram are aligned in the north-south or east-west direction.

GEOLOGIC DATA

Geologic data used to determine the distribution and thickness of the formations were derived from surface exposures, from wells that penetrate these formations, and from published reports. Principally, about 100 electric logs of deep oil tests were used to determine the base of the White River Group, which is also the base of the Tertiary rocks in the area. In most of the area the Tertiary rocks are underlain by the Lance Formation of Cretaceous age, which contains considerable sandstone. In many logs, particularly near Pine Bluffs and Carpenter, Wyo., a clay bed—generally less than 50 feet thick—forms a conspicuous marker horizon. This clay bed is believed by N. M. Denson (oral commun., 1979) to represent a paleosol (ancient soil) that was formed prior to deposition of the White River Group. For convenience of plotting, this paleosol was included with the White River Group. The available electric logs and a few hundred drillers' logs of water wells were used to determine contacts between the Tertiary formations. In the area where the sandy Ogallala Formation overlies the clayey part (Brule Formation) of the White River Group, the contact generally is easily discerned. Many drillers' logs of water wells completed in the area note a clayey sequence below the sandy section (Ogallala Formation) as the "Brule clay". Owing to lithologic similarities, the contact between the Ogallala Formation and the sandy Arikaree Formation generally was determined rather arbitrarily. The Arikaree-White River contact was approximately determined at the point where a decrease in the amount of sandstone is indicated in the logs. Distribution and thickness of the sequence of conglomeratic sandstone to mudstone were obtained from surface exposures and from drillers' logs.

The sequence of conglomeratic sandstone to mudstone (table 1) occurs in the lower part of the White River Group. This sequence was delineated only in the southeastern part of the area. Its distribution is not known but a similar conglomeratic sandstone was recognized in cuttings of a water well drilled near Cheyenne, Wyo. In exposures, the conglomeratic sandstone fills channels cut into fine-grained beds of the White River. Trends of the old channels generally are east-northeastward. The thickness of the Quaternary terrace deposits was determined principally from drillers' logs. Only the terrace deposits in the southeastern part of the area are shown in the diagram.

POTENTIOMETRIC SURFACE

The potentiometric surface is that surface which represents the static head of ground water. Hydraulic interconnection between the Tertiary rocks is assumed to be sufficient to consider the White River Group, Arikaree Formation, Ogallala Formation, and, locally, the Quaternary terrace deposits as a single ground-water reservoir (aquifer) or water-yielding system. The potentiometric surface shown in the diagram is representative of the water level during March 1977. Configuration of the potentiometric surface is affected by surface drainage, particularly Crow and Horse Creeks. Crow Creek is a gaining stream (potentiometric surface above water in the stream) in the vicinity of Cheyenne, Wyo., but east of the city it is a losing stream (potentiometric surface below water in the stream). Horse Creek is a gaining stream through most of its course in the area.

Abrupt changes occur in the potentiometric-surface gradient, such as west of Carpenter, Wyo., and south of Pine Bluffs, Wyo. These two areas occur along an escarpment where the Ogallala Formation has been eroded away to expose the White River Group directly underneath. Because few springs are present along the Ogallala-White River contact, it is assumed that the steep potentiometric-surface gradient indicates a change in hydraulic conductivity as the ground water moves downward to lower beds.

TABLE 1.—*Brief lithologic and hydrologic description of the Quaternary terrace deposits and the Tertiary formations*

Stratigraphic unit	Lithology	Hydrology
Terrace deposits (Qts)	Consists of sand and gravel with varying amounts of silty sand, silt, and clay. In some exposures sand to sandy silt forms most of the deposit. Deposits show only in southeastern part.	Yields water to irrigation and domestic wells. Unit contains water only in area near Carpenter, Wyo., and Hereford, Colo.
Ogallala Formation (To)	Consists mainly of a heterogeneous mixture of generally weakly to firmly cemented conglomerate, sandstone, siltstone, and claystone containing some inerbeds of limestone and well-cemented conglomerate.	Yields water to irrigation, industrial, public supply, stock, and domestic wells. Unit is dry along bluffs and escarpments.
Arikaree Formation (Ta)	Consists predominantly of a massive and cross-stratified, moderately cemented sandstone that contains beds of siltstone, layers of hard concretionary sandstone, and thin beds of volcanic ash. Locally, a coarse conglomerate occurs at the base.	Yields water to irrigation, domestic, and stock wells. Generally, unit is less permeable than Ogallala Formation.
White River Group (Tw)	Consists mainly of bedded or massive, weakly to moderately cemented siltstone that contains silty sandstone, sandstone, and some conglomerate, claystone, and volcanic ash.	Yields water to irrigation, industrial, public supply, stock, and domestic wells. Unit is principal aquifer southwest of Carpenter, Wyo., and near Pine Bluffs, Wyo. Water occurs mainly in openings along fractures and probably bedding planes. Sandstone and conglomerate beds yield water locally.
Sequence of conglomerate to mudstone (Twa)	Consists mainly of arkosic, weakly to moderately cemented sandstone to conglomeratic sandstone, siltstone to sandy siltstone, and mudstone. This sequence occurs in the middle of the White River Group. Unit shown only in southeastern part.	Yields some water to wells, partly in combination with the terrace deposits.

SELECTED REFERENCES

Additional information on the geology and hydrology of the area is available in the following selected references:

Bjorklund, L. J., 1957, Geology and ground-water resources of the lower Lodgepole Creek drainage basin, Nebraska, *with a section on* Chemical quality of water, by E. R. Jochens: U.S. Geological Survey Water-Supply Paper 1410, 76 p.

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Weist, W. G., Jr., 1964, Reconnaissance of the ground-water resources in parts of Larimer, Logan, Morgan, Sedgwick, and Weld Counties, Colorado: U.S. Geological Survey Water-Supply Paper 1809-L, p. L1–L24.

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GENERALIZED FENCE DIAGRAM SHOWING STRATIGRAPHY AND POTENTIOMETRIC SURFACE OF THE TERTIARY FORMATIONS IN SOUTHEASTERN WYOMING AND AN ADJACENT PART OF COLORADO

By

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Geology by M. E. Cooley, 1978;
hydrology by M. A. Crist, 1977

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