

INTRODUCTION

The purpose of the investigation is to provide a description of the principal geohydrologic systems in Upper Cambrian through Lower Cretaceous rocks in Kansas. This investigation was made as part of the Central Midwest Regional Aquifer-System Analysis (CMRASA). The CMRASA is one of several major investigations by the U.S. Geological Survey of regional aquifer systems in the United States. These regional investigations are designed to increase knowledge of the flow regime and hydrologic properties of major aquifer systems and to provide quantitative information for the assessment, development, and management of water supplies. The CMRASA study area includes all or parts of 10 Central Midwestern States (Jorgensen and Signor, 1981), as shown in the envelope cover.

The Hydrologic Investigations Atlas, which consists of a series of chapters, presents a description of the physical framework and geohydrology of principal aquifers and confining systems in Kansas. Chapter H presents the geohydrology of the upper aquifer unit in the Western Interior Plains aquifer system. The physical framework of the aquifer system in relation to other systems is described by maps and sections showing areal extent and the thickness of rocks that compose the unit. The physical framework of the upper aquifer unit is described in detail in chapter D of the atlas (Hansen and others, in press). The hydrology of the system in relation to that of other systems is described in this chapter by maps showing the altitude of fluid levels and the direction of water movement within the unit. The chemical composition of water in the system is described by maps that show the distribution of dissolved solids concentrations and the difference in water types on the basis of principal chemical constituents. Chapter A of this atlas series (Wolf and others, 1990) describes the relation of principal geohydrologic systems in Kansas and presents a more detailed discussion of the methods and data used to prepare and ensure consistency among the sets of maps.

Maps in this chapter are based on available data from selected geophysical and lithologic logs, drill-stem tests, water-level measurements, and water quality analyses and from published maps of stratigraphically equivalent units. An index to the geohydrologic data compiled for the CMRASA in Kansas is presented in Synthesis and others (1987). Note that most of the data used to construct the maps were collected at different times and, therefore, do not reflect aquifer conditions for any specific time period. The reader should refer to the "Selected References" contained on sheet 2 of this chapter for a listing of the published material used as part of map completion. Well in this report are numbered according to a modification of the U.S. Bureau of Land Management's system of land subdivision. In this system, the first set of digits of a well number indicates the township south (S) of the Kansas-Nebraska State line; the second set, the range east (E) or west (W) of the sixth principal meridian; the third set, the section in which the well is situated. The first letter of the third set of digits denotes the quarter section, or 160-acre tract within the section; the second, the quarter-quarter section, or 40-acre tract; the third, the quarter-quarter-quarter section, or 10-acre tract. Subdivisions of each section are designated A, B, C, D in a counterclockwise direction beginning in the northeast quadrant. In the following example diagram, well 34S-25E-4AD8 is located in the northwest quarter of the southeast quarter of the northeast quarter of section 4, township 34 south, range 25 east.

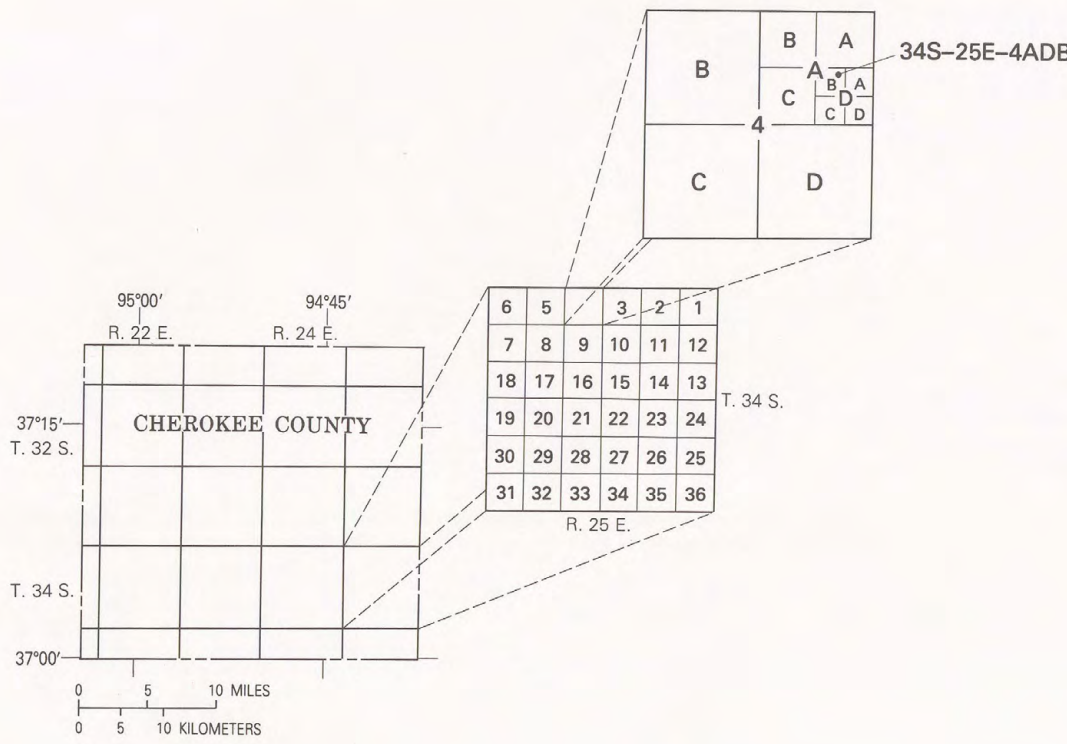


TABLE 1. Generalized stratigraphic units and related geohydrologic systems

| SYSTEM        | Series      | Provincial series | Geologic unit                                   | Geohydrologic systems            |  |
|---------------|-------------|-------------------|---|----------------------------------|--|
|               |             |                   |   | Subdivisions                     | Major systems                            |
| QUATERNARY    | Holocene    |                   | Undifferentiated Quaternary deposits            |                                  | Aluvial and glacial-drift aquifer system |
|               | Pleistocene |                   |   |                                  |  |
| TERTIARY      | Miocene     |                   | Ogallala Formation                              |                                  | High Plains aquifer system               |
|               | Upper       |                   | Undifferentiated Upper Cretaceous rocks         |                                  | Great Plains confining system            |
| CRETACEOUS    | Lower       |                   | Dakota Formation                                | Upper aquifer unit               | Great Plains aquifer system              |
|               |             |                   | Kiowa Shale                                     | Confining unit                   |  |
|               |             |                   | Cheyenne Sandstone                              | Lower aquifer unit               |  |
| JURASSIC      | Upper       |                   | Morrison Formation                              | Upper unit                       |  |
|               |             |                   | Undifferentiated Upper Jurassic rocks           |                                  |  |
| PERMIAN       | Upper       |                   | Big Basin Formation                             | Lower unit                       | Western Interior Plains confining system |
|               |             |                   | Day Creek Dolomite                              |                                  |  |
|               |             |                   | Wabenshale Formation                            |                                  |  |
|               | Lower       |                   | Nippewalla Group                                |                                  |  |
|               |             |                   | Day Creek Formation                             |                                  |  |
| PENNSYLVANIAN | Upper       |                   | Sumner Group                                    | Lower unit                       | Western Interior Plains confining system |
|               |             |                   | Stane Coral Formation                           |                                  |  |
|               |             |                   | Nemacosh Shale                                  |                                  |  |
|               |             |                   | Wallerburg Formation                            |                                  |  |
|               |             |                   | Chase Group                                     |                                  |  |
| MISSISSIPPIAN | Upper       |                   | Wabenshale Group                                | Upper aquifer unit               | Western Interior Plains aquifer system   |
|               |             |                   | Shawnee Group                                   |                                  |  |
|               |             |                   | Douglas Group                                   |                                  |  |
|               | Lower       |                   | Loring Group                                    |                                  |  |
|               |             |                   | Kansas City Group                               |                                  |  |
| DEVONIAN      | Upper       |                   | Unconformity                                    | Confining unit                   | Western Interior Plains aquifer system   |
|               |             |                   | Unconformity                                    |                                  |  |
|               |             |                   | Unconformity                                    |                                  |  |
|               |             |                   | Unconformity                                    |                                  |  |
|               |             |                   | Unconformity                                    |                                  |  |
| ORDOVICIAN    | Upper       |                   | Maquokette Shale                                | Upper part of lower aquifer unit | Western Interior Plains aquifer system   |
|               |             |                   | Maquokette Shale                                |                                  |  |
|               |             |                   | Maquokette Shale                                |                                  |  |
|               |             |                   | Maquokette Shale                                |                                  |  |
|               |             |                   | Maquokette Shale                                |                                  |  |
| CAMBRIAN      | Upper       |                   | Arbuckle Group                                  | Lower part of lower aquifer unit | Basement confining system                |
|               |             |                   | Arbuckle Group                                  |                                  |  |
|               |             |                   | Arbuckle Group                                  |                                  |  |
|               |             |                   | Arbuckle Group                                  |                                  |  |
|               |             |                   | Arbuckle Group                                  |                                  |  |
| PRECAMBRIAN   | Upper       |                   | Igneous, metamorphic, and metasedimentary rocks | Basement confining system        | Basement confining system                |
|               |             |                   | Igneous, metamorphic, and metasedimentary rocks |                                  |  |
|               |             |                   | Igneous, metamorphic, and metasedimentary rocks |                                  |  |
|               |             |                   | Igneous, metamorphic, and metasedimentary rocks |                                  |  |
|               |             |                   | Igneous, metamorphic, and metasedimentary rocks |                                  |  |

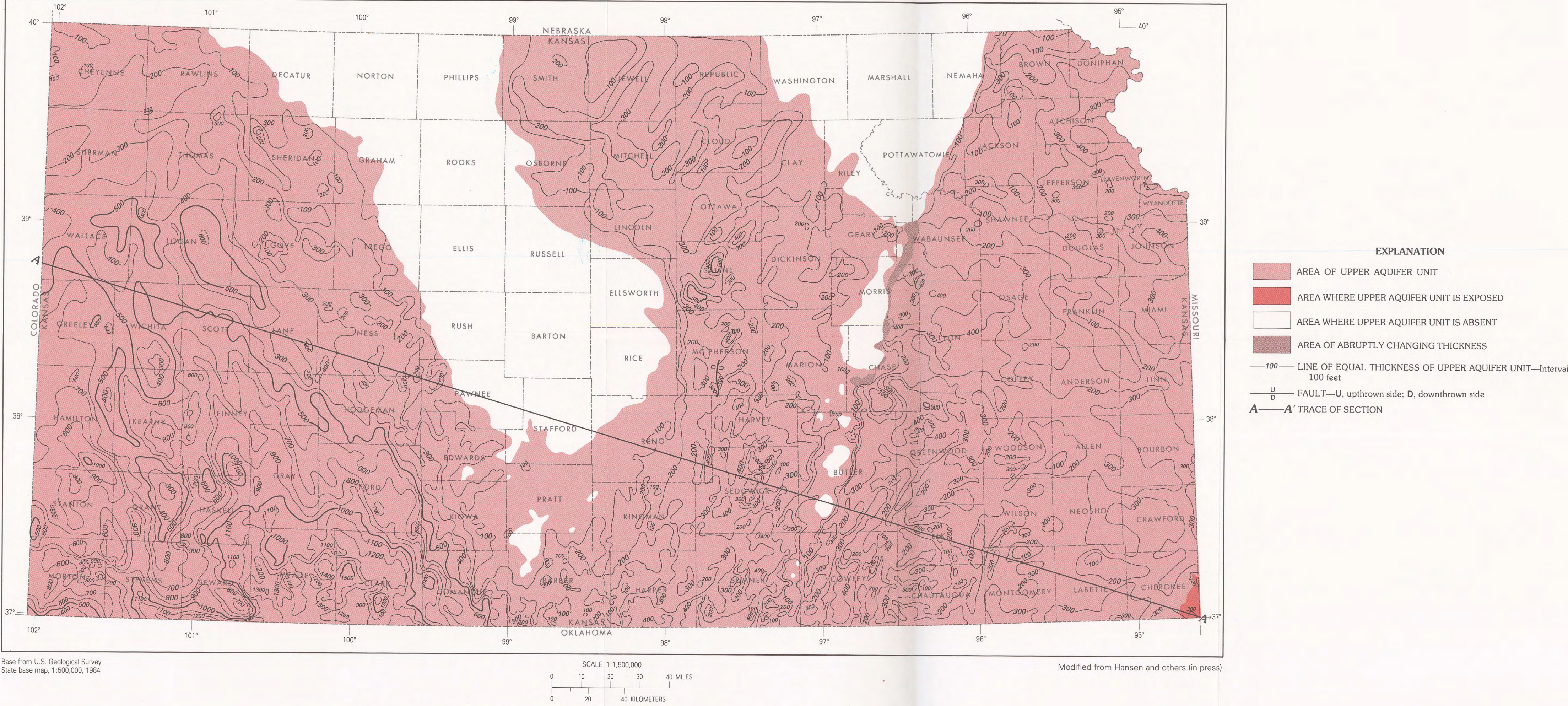


FIGURE 1.—Geohydrologic map showing extent and thickness of upper aquifer unit in Western Interior Plains aquifer system.

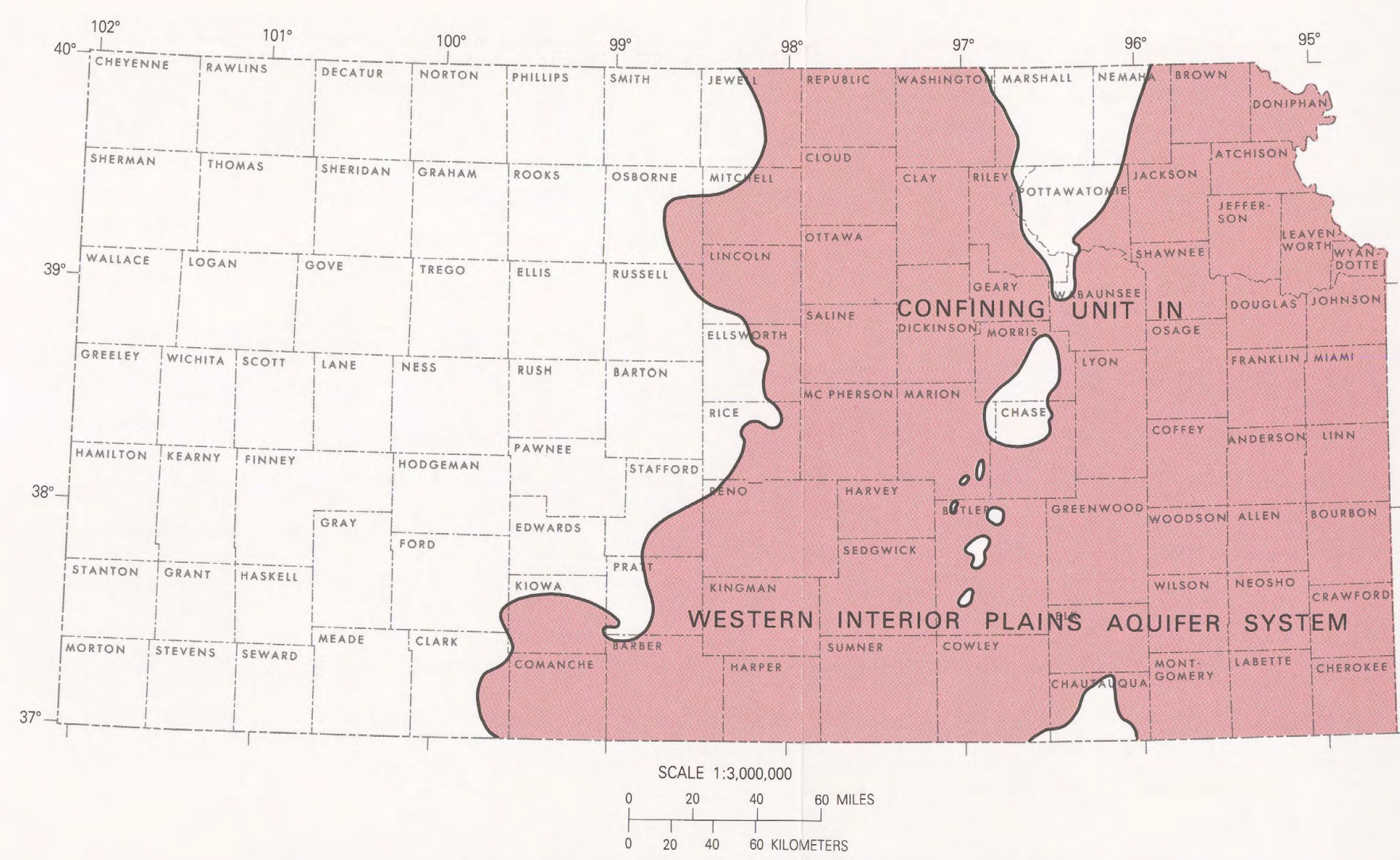


FIGURE 3.—Geologic map showing extent of confining unit in Western Interior Plains aquifer system.

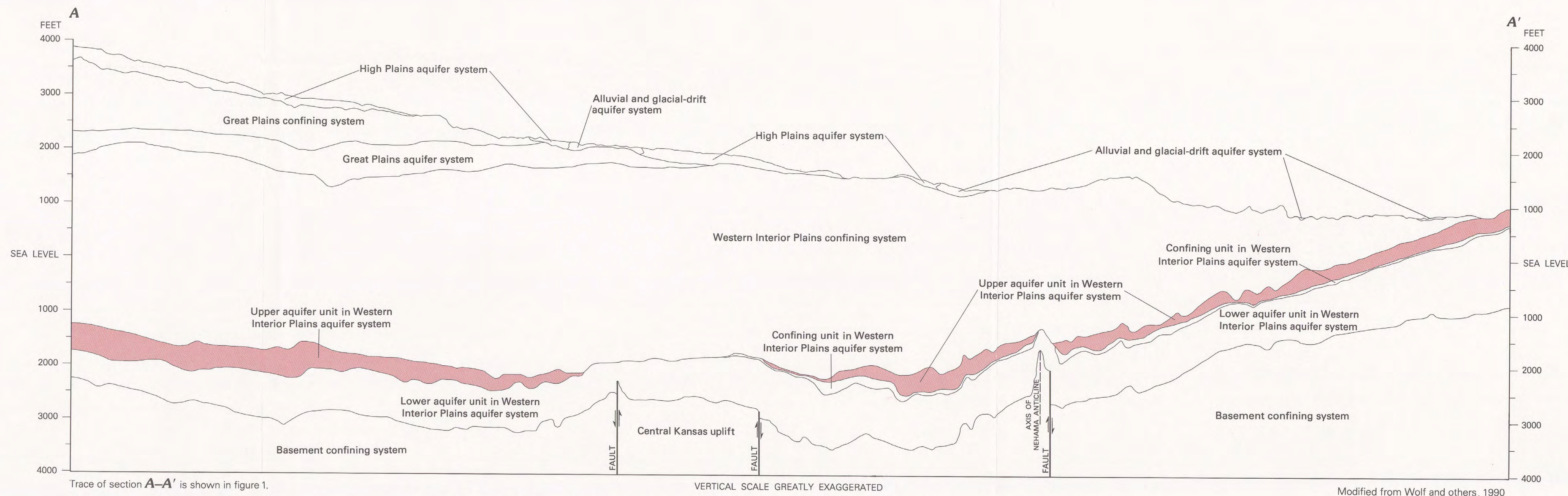


FIGURE 4.—Geohydrologic section showing relation of upper aquifer unit in Western Interior Plains aquifer system to other geohydrologic systems.

DESCRIPTION OF PHYSICAL CHARACTERISTICS

The Western Interior Plains aquifer system is included within the rocks of Late Cambrian to Late Mississippian age in Kansas. In the extreme southeastern corner of the State, the system also has been included with adjacent States as part of a CMRASA subregional analysis for the Ozark Plateau aquifer system. For ease of mapping and convenience of discussion, only the terminology for the Western Interior Plains aquifer system is used in this report.

Two aquifer units and an intervening confining unit are identified within the Western Interior Plains aquifer system. The upper aquifer unit of the aquifer system comprises of permeable limestone, cherty limestone, and dolomite of Mississippian age. This upper unit includes carbonate rocks from the uppermost part of the Kinderhookian through the Meramec Provincial Series, as shown in table 1. It is equivalent to the Ozark Plateau aquifer system (Innes, 1990). Rocks in the upper aquifer unit of the Western Interior Plains aquifer system underlie most of Kansas (fig. 1). They are exposed in the extreme southeastern corner of the State and are absent in areas where they have been eroded from the Central Kansas Uplift and the Nemaha Anticline (fig. 2). Thickness of the upper aquifer unit is greatest in the basin areas, reaching a maximum of about 1,500 feet in the Hugoton Embayment.

The upper aquifer unit is underlain throughout most of the eastern one-half of Kansas by the predominantly shale sequences of Late Devonian through Early Kinderhookian age, which is known as the confining unit of the Western Interior Plains aquifer system (fig. 3). Where present, these rocks separate the upper and lower aquifer units of the Western Interior Plains aquifer system. The confining unit is equivalent, in part, to the Ozark confining unit in the subregional Ozark Plateau aquifer system analysis (Innes, 1990). In western Kansas, where the confining unit is absent, the upper aquifer unit lies directly above the lower aquifer unit of the Western Interior Plains aquifer system, and the two units function as one aquifer.

The lower aquifer unit in the Western Interior Plains aquifer system consists of a thick series of limestone, dolomite, shale, and sandstone of Late Cambrian through Early Devonian age. This geohydrologic unit occurs throughout the State except for areas of the Central Kansas Uplift and the Nemaha Anticline. The lower aquifer unit is described in Chapters F and I of this series.

The Western Interior Plains aquifer system is overlain by a thick, predominantly shale sequence of Late Mississippian through Jurassic age, which is known as the Western Interior Plains confining system. This confining system is present throughout Kansas, except for a small area in the southeastern corner. The Western Interior Plains aquifer system is underlain by igneous, metamorphic, and metasedimentary rocks of Precambrian age, which is known as the basement confining unit.

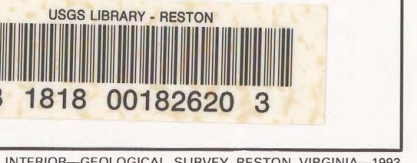
The stratigraphic relation of the Western Interior Plains aquifer system to overlying and underlying geohydrologic systems is illustrated in figure 4.

Altitude and configuration of the top of the upper aquifer unit in the Western Interior Plains aquifer system are shown in figure 5. Altitude of the top ranges from a maximum of about 900 feet above sea level at the outcrop area in southeastern Kansas to a minimum of about 4,100 feet below sea level in Clark and Wade Counties, southwestern Kansas.

CONVERSION FACTORS AND VERTICAL DATUM

| Multiply   | By      | To obtain   |
|--|---------|---|
| foot   | 0.3048  | meter   |
| mile   | 1.609   | kilometer   |
| square mile  | 2.590   | square kilometer  |
| gallon per minute (gal/min)  | 0.06309 | liter per second  |
| cubic foot per day per square foot times foot of aquifer thickness | 0.09290 | cubic meter per day per square meter times meter of aquifer thickness |

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929—a geoid datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called Sea Level Datum of 1929.



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