INTRODUCTION

This Hydrologic Investigations Atlas, which consists of a series of chapters, presents a description of (1) the physical framework and (2) the geohydrology of the principal aquifers and confining systems in Kansas. The report is the result of an investigation that has been made as part of the Central Midwest Regional Aquifer System Analysis (CMRASA), one of several major investigations by the U.S. Geological Survey to define regional aquifer systems. These regional analyses are designed to increase knowledge of major flow regimes and provide data for assessing, developing, and managing water supplies. The CMRASA is an investigation of water in Upper Cambrian through Lower Cretaceous rocks in parts of 10 Central Midwestern States, as shown by the map on the envelope cover (modified from Jorgensen and Signor, 1981).

Purpose and Scope

Chapter A presents a general description of the framework of all principal geohydrologic systems in Kansas with emphasis on those systems in Upper Cambrian through Lower Cretaceous rocks in Kansas and provides an overview of hydrologic relations among the different systems. The report also provides a delineation of the equivalent stratigraphic units and a description of the hydrologic properties for each of the systems. Maps and descriptions of stratigraphic units in greater detail that relate to each of the systems within Upper Cambrian through Lower Cretaceous rocks are presented in subsequent chapters.

Methods of Investigation

Data for the investigation in Kansas were obtained from numerous files and published material of Federal, State, and independent agencies. Initially, the data were assembled and selectively analyzed to provide quantitative information for use in the regional analysis. Data were interpreted in relation to the geohydrologic systems designated by the CMRASA investigation. This information was prepared for analysis mostly in the form of data bases and computer-generated maps.

Data bases were compiled to provide information for determining: (1) Formation boundaries and thicknesses based on lithologic and geophysical logs; (2) a potentiometric surface for each aquifer system based on water levels and hydraulic heads in wells; (3) hydraulic properties of the aquifer system related to the direction and quantity of flow; (4) permeability of the confining systems related to the percentages of shale; (5) hydrochemical properties of water in each aquifer system in relation to the dissolved-solids concentrations and principal constituents; and (6) the rates of withdrawal and injection related to the different water uses. A series of maps were prepared from these data to present a regional interpretation of the framework and geohydrology for each system. The maps and data compiled for the regional analyses also have been used to prepare reports on the principal geohydrologic systems in Kansas.

Compilation of Map Features

Data used for preparing maps of physical features in this investigation consisted mostly of geophysical and lithologic logs from files of the Kansas Geological Survey (Lawrence, Kansas). Substantial assistance was provided by Shirley E. Paul and W. Lynn Watney of that agency. Because of the large area and the vast quantity of file data, no additional site data were obtained during the investigation. For the same reasons, only a small number of geophysical and lithologic logs in each county was selected to be representative of the stratigraphic section. Geologic sections and type logs published by the Kansas Geological Society were used as guides in correlating the formation boundaries.

Maps showing the altitude of the surface and the thickness of different geohydrologic systems within the section were prepared as an interrelated series. Where available, published maps of stratigraphically equivalent units were used because these map interpretations were based on a great number of values. Where published data were few, or published maps were not available, values obtained from correlated logs were used. Because published maps by different authors used data from a variety of sources, interpretations of data in some areas were not in agreement. Thus, each map prepared for the study was checked for consistency with all related maps in the series. Altitudes indicated by contours were inspected for agreement with additional values determined from correlated logs and from differences at the location where related altitude contours intersect. Use of these methods provided a consistent technique for preparing all maps in the series.

DESCRIPTION OF GEOHYDROLOGIC SYSTEMS IN KANSAS

Geohydrologic systems in Kansas are comprised of a sequence of major geologic units that are lithologically similar and collectively function as an aquifer system or a confining system. The principal aquifer and confining systems described in this report generally correspond with those geohydrologic systems designated by the CMRASA investigation. Because some stratigraphic differences occur form one area to another within the region, however, the designations based on formational boundaries in Kansas may differ, in part, from those used in adjacent States. The major aquifer systems in Kansas, as listed in stratigraphically descending order, consist of the alluvial and glacial-drift, High Plains, Great Plains, and Western Interior Plains aquifer systems. The major confining systems include the Great Plains, Western Interior Plains, and basement confining systems.

Within the major geohydrologic systems in Kansas, minor units commonly occur that are lithologically and functionally dissimilar from the major systems. Most of these minor units have little hydrologic significance because they are thin or are of limited areal extent. A few minor units, however, have differences that are sufficiently great to be defined separately as subdivisions. Relations among the principal geohydrologic systems are illustrated in section **A–A′**, as shown in figure 1. Relations among the major systems and subdivisions, as shown on maps and sections in the report, are described in the following discussions. Subdivisions that differ greatly from the principal systems in Kansas are designated only in reference to the relative position, such as upper or lower unit. The major geohydrologic systems and subdivisions are listed with the equivalent stratigraphic units in table 1. The outcrop or subcrop of principal geohydrologic systems within Upper Cambrian through Lower Cretaceous rocks is shown in figure 2. The extent of geohydrologic systems overlying Lower Cretaceous rocks is shown in figure 3.

Many of the maps, sections, and related discussions in this report refer to structural features in the subsurface. Names of the major structural features or provinces are those used by the Kansas Geological Survey (from Merriam, 1963), as shown in figure 4.

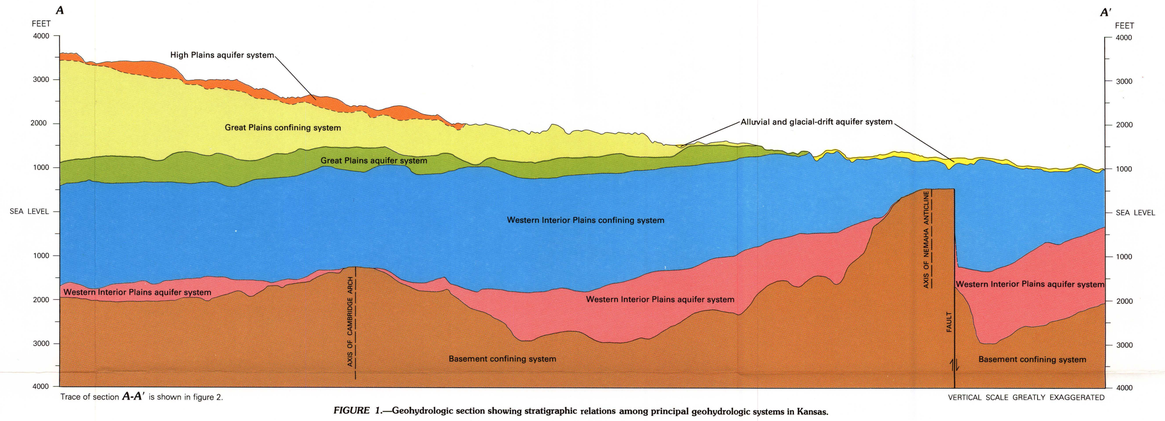
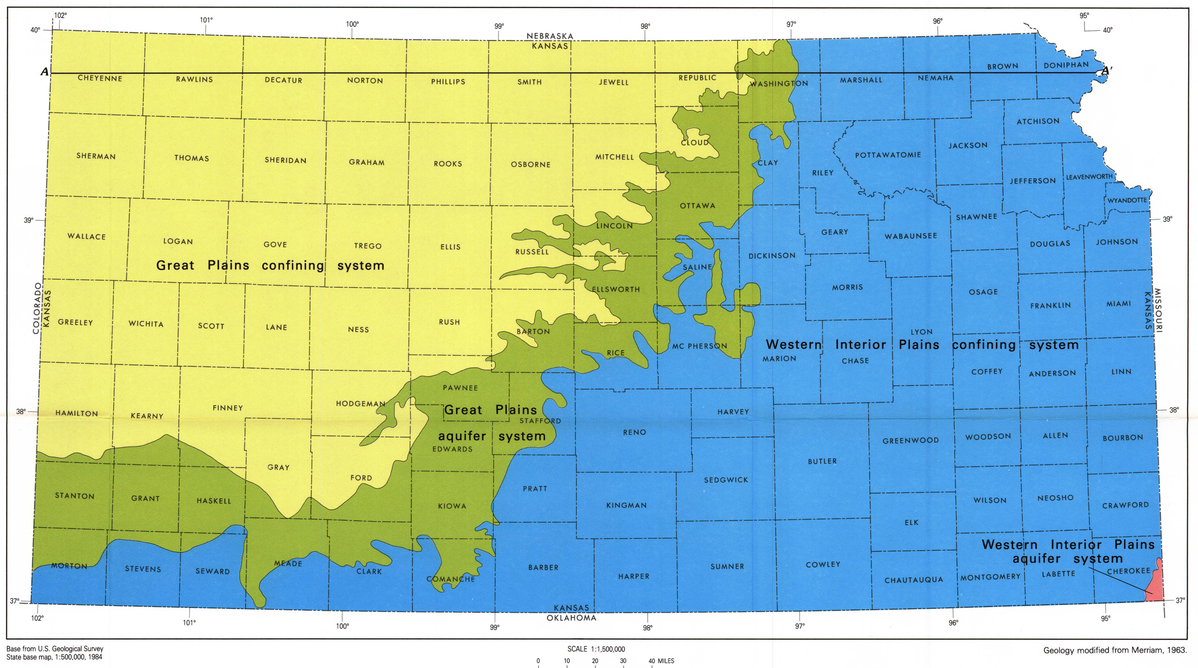


FIGURE 1.—**Geohydrologic section showing stratigraphic relations among principal geohydrologic systems in Kansas.**



Base from U.S. Geological Survey
State base map, 1:500,000, 1984

SCALE 1:1,500,000
0 10 20 30 40 MILES
0 20 40 KILOMETERS

Geology modified from Merriam, 1963.

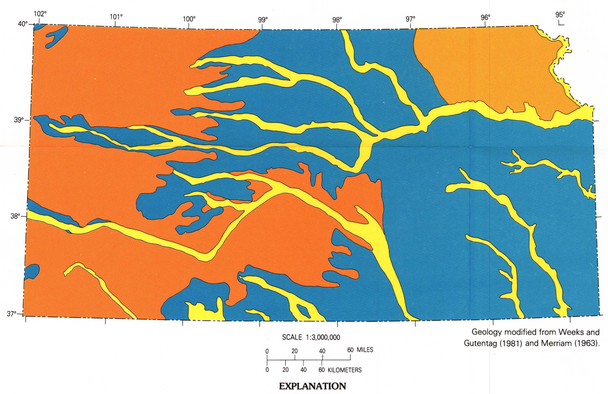
EXPLANATION

A——*A′* TRACE OF GEOHYDROLOGIC SECTION

FIGURE 2.—**Map showing outcrop or subcrop of principal geohydrologic systems within Upper Cambrian through Lower Cretaceous rocks.**

***TABLE 1.* Generalized stratigraphic units and related geohydrologic systems**

SYSTEM	Series	Provincial series	Geologic unit	Geohydrologic systems: Subdivisions	Geohydrologic systems: Major systems
QUATERNARY	Holocene Pleistocene		Undifferentiated Quaternary deposits		Alluvial and glacial-drift aquifer system
TERTIARY	Miocene		Ogallala Formation		High Plains aquifer system
CRETACEOUS	Upper		Undifferentiated Upper Cretaceous rocks		Great Plains confining system
	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	Western Interior Plains confining system
			Undifferentiated Upper Jurassic rocks		
PERMIAN	Upper		Big Basin Formation	Lower unit	
	Lower		Day Creek Dolomite Whitehorse Formation Nippewalla Group Dog Creek Formation Blaine Formation Flowerpot Shale Cedar Hills Sandstone Salt Plains Formation Harper Sandstone Sumner Group Stone Corral Formation Ninnescah Shale Wellington Formation Chase Group Council Grove Group Admire Group		
PENNSYLVANIAN	Upper	Virgilian	Wabaunsee Group Shawnee Group Douglas Group		
		Missourian	Undifferentiated Missourian rocks		
	Middle	Desmoinesian	Undifferentiated Desmoinesian rocks		
		Atokan	Undifferentiated Atokan rocks		
	Lower	Morrowan	Undifferentiated Morrowan rocks		
MISSISSIPPIAN	Upper	Chesterian	Undifferentiated Chesterian rocks		
	Lower	Meramecian	Undifferentiated Upper and Lower Mississippian rocks	Upper aquifer unit	Western Interior Plains aquifer system
		Osagean			
		Kinderhookian			
DEVONIAN			Undifferentiated Lower Mississippian and Upper Devonian rocks	Confining unit	
SILURIAN			Hunton Formation	Upper part of lower aquifer unit	
ORDOVICIAN	Upper		Maquoketa Shale		
	Middle		Viola Limestone Simpson Group		
	Lower		Arbuckle Group	Lower part of lower aquifer unit	
CAMBRIAN	Upper				
PRECAMBRIAN			Igneous, metamorphic, and metasedimentary rocks		Basement confining system



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0 20 40 60 KILOMETERS

Geology modified from Weeks and Gutentag (1981) and Merriam (1963).

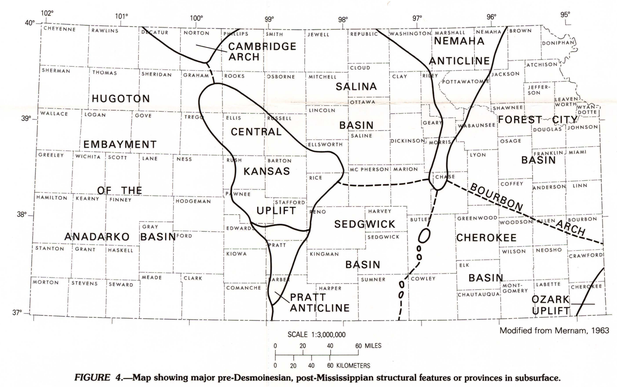
EXPLANATION

ALLUVIAL AND GLACIAL-DRIFT AQUIFER SYSTEM
Alluvial aquifers
Glacial-drift aquifers

HIGH PLAINS AQUIFER SYSTEM

GEOHYDROLOGIC SYSTEMS IN UPPER CAMBRIAN THROUGH UPPER CRETACEOUS ROCKS

FIGURE 3.—**Map showing extent of alluvial and glacial-drift, and High Plains aquifer systems.**



SCALE 1:3,000,000
0 20 40 60 MILES
0 20 40 60 KILOMETERS

Modified from Merriam, 1963

FIGURE 4.—**Map showing major pre-Desmoinesian, post-Mississippian structural features or provinces in subsurface.**

CONVERSION TABLE

For those readers interested in metric units, the factors for converting inch-pound units to the International System (SI) of units are given below:

Multiply inch-pound units	By	To obtain SI units
foot	0.3048	meter
mile	1.609	kilometer
square mile	2.590	square kilometer
gallon per minute	0.06309	liter per second

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929—a geodetic 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."

GEOHYDROLOGIC SYSTEMS IN KANSAS WITH EMPHASIS ON SYSTEMS IN UPPER CAMBRIAN THROUGH LOWER CRETACEOUS ROCKS

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