DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS INVESTIGATIONS SERIES
MAP I-1235-B

EXPLANATION

The concentrations of dissolved solids in water from most springs and water wells less than 1000 feet deep should be within the ranges shown. Dissolved-solids concentrations determined by laboratory analyses except where "E" indicates an estimate from specific conductance of the water as determined by field-conductivity meter.

DISSOLVED-SOLIDS CONCENTRATION, IN MILLIGRAMS PER LITER

- 100-500
- 100-1000
- 500-1000
- 500-3000
- 1000-3000
- 3000-10,000

Data site used for control

- Water well
- Spring
- Stream (base flow)

INTRODUCTION

This is one in a series of maps that describes the geology and related natural resources of the Alton-Kolob coal-fields area, Utah. The purpose of this map is to show regional variations in ground-water quality as depicted by its dissolved-solids concentration. The map is based on chemical analyses of water samples from springs, streams during base flow, and wells less than 1,000 feet deep. There are significant areal and vertical variations in the ground-water quality—especially in those areas where the dissolved-solids concentrations range from 100 to 1,000 and from 500 to 3,000 mg/L (milligrams per liter). Consequently, determination of the actual chemical quality of the ground water, including concentrations of specific ions in any given locality, can be made only by special investigation.

Most data used to compile this map were collected by the U.S. Geological Survey in cooperation with the Utah Division of Water Rights and are given in the following reports: Marine (1963), Carpenter, Robinson, and Bjorklund (1964), Goode (1964, 1966), Cordova, Sandberg, and McConkie (1972), Bjorklund, Sumsion, and Sandberg (1977, 1978), and Cordova (1980). In those areas where few or no water-quality data were available for ground water, the ranges of dissolved solids were inferred largely from the geology (Stokes, 1964) and its known effect on ground-water quality in adjacent areas.

QUALITY OF GROUND WATER

Ground water in the Alton-Kolob coal-fields area generally ranges from fresh to slightly saline according to the following water-quality classification used by the U.S. Geological Survey:

Class	Dissolved-solids concentration (milligrams per liter)
Fresh	Less than 1,000
Slightly saline	1,000 to 3,000
Moderately saline	3,000 to 10,000
Very saline	10,000 to 35,000
Briny	More than 35,000

The freshest ground water commonly occurs in the high plateau areas, which include the headwaters of the principal streams—the Sevier, Virgin, and Paria Rivers and Parowan, Summit, Coal Ash, and Kanab Creeks. In these areas, concentrations of dissolved solids in ground water generally are less than 500 mg/L (milligrams per liter) and commonly less than 250 mg/L. Most water sampled in these areas occurs in the unconsolidated deposits of Quaternary age, the Wasatch Formation of Tertiary age, igneous rocks of Tertiary and Quaternary age, and sandstones of Late Cretaceous age.

Water containing generally less than 500 mg/L of dissolved solids also occurs in the Navajo Sandstone of Late Triassic(?) and Jurassic age. Of 41 water samples from wells and springs in the Navajo where it underlies that part of the map area drained by the Virgin River and Kanab Creek, the dissolved-solids concentrations ranged from 74 to 905 mg/L and averaged 270 mg/L (Cordova, 1980, p. 70). It should be noted, however, that most of these water samples were collected in areas where the Navajo crops out or is near the land surface. In areas where the formation extends beneath younger rocks, such as in the Alton area, the formation may contain saline water.

Saline water commonly occurs in the Moenkopi and Chinle Formations of Triassic age, the Carmel Formation of Jurassic age, and the Tropic Shale of Cretaceous age. These formations crop out extensively in the southern one-half of the map area where dissolved-solids concentrations in water generally ranged from 500 to 3,000 mg/L; however, most water sampled contained 1,000 to 3,000 mg/L of dissolved solids and several samples contained 3,000 to 10,000 mg/L.

Most water available for development in the northwestern part of the map (Cedar and Parowan Valleys and Escalante Desert) occurs in unconsolidated valley-fill deposits of Quaternary age. Dissolved-solids concentrations of the ground water throughout Parowan Valley generally are less than 500 mg/L. In Cedar Valley and the Escalante Desert, dissolved-solids concentrations commonly range from 500 to 1,000 mg/L and locally range from 1,000 to 3,000 mg/L. The larger concentrations in Cedar Valley may be attributed chiefly to dissolution of soluble minerals from detritus in the valley fill that originated from Triassic and Jurassic rocks (Bjorklund and others, 1978, p. 69). Those rocks include the Moenkopi, Chinle, and Carmel Formations. The larger concentrations in the Escalante Desert may be attributed to very slow movement of ground water and concentrations of the dissolved minerals by evapotranspiration.

The most saline water sampled in the area was from La Verkin (Dixie) Hot Springs. A sample collected from the springs on March 25, 1966, contained 9,530 mg/L of dissolved solids (Mundorff, 1970, p. 18). The source of the water has been postulated to be the Kaibab Limestone of Permian age (Milligan and others, 1966, p. 42). However, the thermal water from La Verkin (Dixie) Hot Springs has probably dissolved minerals from various geologic sources during deep circulation and, consequently, is not representative of water in the Kaibab. Nonthermal water in the Kaibab where that formation underlies the map area probably is fresher.

Ground water in the map area varies considerably in chemical character depending largely on the geologic source and concentration of dissolved solids. In waters that contain less than 500 mg/L of dissolved solids, such as those in the Wasatch Formation, volcanic rocks of the higher altitudes, and the Navajo Sandstone, calcium and magnesium generally are the principal cations and bicarbonate the principal anion. In waters that contain more than 1,000 mg/L, such as those in the Moenkopi, Chinle, and Carmel Formations, magnesium or sodium commonly are the dominant cations and sulfate commonly is the dominant anion. In water from La Verkin (Dixie) Hot Springs, however, sodium and chloride are the dominant cation and anion. The reader is referred to the reports listed below or to the U.S. Geological Survey, Salt Lake City, Utah, for chemical analyses of water collected at specific sites in the map area.

REFERENCES CITED

Bjorklund, L. J., Sumsion, C. T., and Sandberg, G. W., 1977, Selected hydrologic data, Parowan Valley and Cedar City Valley drainage basins, Iron County, Utah: U.S. Geological Survey open-file report (published as Utah Basic-Data Release 28), 55 p.

_____1978, Ground-water resources of the Parowan-Cedar City drainage basin, Iron County, Utah: Utah Department of Natural Resources Technical Publication 60, 93 p.

Carpenter, C. H., Robinson, G. B., Jr., and Bjorklund, L. J., 1964, Selected hydrologic data, upper Sevier River basin, Utah: U.S. Geological Survey open-file report (published as Utah Basic-Data Report 8), 29 p.

Cordova, R. M., 1980, Ground-water conditions in the upper Virgin River and Kanab Creek basins area, Utah, with emphasis on the Navajo Sandstone: U.S. Geological Survey Open-File Report 80-524, 126 p.

Cordova, R. M., Sandberg, G. W., and McConkie, Wilson, 1972, Ground-water conditions in the central Virgin River basin, Utah: Utah Department of Natural Resources Technical Publication 40, 64 p.

Goode, H. D., 1964, Reconnaissance of water of part of western Kane County, Utah: Utah Geological and Mineralogical Survey Water-Resources Bulletin 5, 63 p.

_____1966, Second reconnaissance of the water resources in western Kane County, Utah: Utah Geological and Mineralogical Survey Water-Resources Bulletin 8, 44 p.

Marine, I. W., 1963, Ground-water resources of the Bryce Canyon National Park area, Utah: U.S. Geological Survey Water-Supply Paper 1475-M, p. 441-486.

Milligan, C. H., Marsell, R. E., and Bagley, J. M., 1966, Mineralized springs in Utah and their effects on manageable water supplies: Utah State University Water Research Laboratory Report WC 23-6, 50 p.

Mundorff, J. C., 1970, Major thermal springs of Utah: Utah Geological and Mineralogical Survey Water-Resources Bulletin 13, 60 p.

Stokes, W. L., 1964, Geologic map of Utah: University of Utah, scale 1:250,000.

INDEX MAP OF UTAH

Base from U.S. Geological Survey 1:250,000 series:
Cedar City, Utah, 1953 (1971 revision)

SCALE 1:125 000

2 0 2 4 6 8 MILES
2 0 2 4 6 8 KILOMETERS

CONTOUR INTERVAL 200 FEET
WITH SUPPLEMENTARY CONTOURS AT 100-FOOT INTERVALS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

1981 MAGNETIC DECLINATION FOR THIS SHEET VARIES FROM 14°05' EASTERLY FOR THE CENTER OF THE WEST EDGE TO 14°56' EASTERLY FOR THE CENTER OF THE EAST EDGE. MEAN ANNUAL CHANGE IS 9'S.S.I. WESTERLY

INTERIOR—GEOLOGICAL SURVEY, RESTON, VA.—1981—W80068

MAP SHOWING GENERAL CHEMICAL QUALITY OF GROUND WATER IN THE ALTON-KOLOB COAL-FIELDS AREA, UTAH

By
Don Price

1981

For sale by Branch of Distribution, U.S. Geological Survey, Box 25286, Federal Center, Denver, CO 80225