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DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE
ARIZONA WATER COMMISSION

WATER-RESOURCES INVESTIGATIONS 77-44
OPEN-FILE REPORT (SHEET 3 OF 3)

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TOREVA AND WEPO FORMATIONS

The Toreva and Wepo Formations crop out in most of the southern part of the northern part of the Black Mesa area. The Toreva Formation consists of a basal sandstone member, a middle carbonaceous member, and an upper sandstone member. The Wepo Formation consists of a thick series of intercalated siltstone, mudstone, sandstone, and coal beds. The combined thickness of the formations ranges from about 1,000 ft east of Cow Springs Trading Post to about 600 ft near Yale Point

Ground water in the Toreva and Wepo Formations is under water-table conditions. Most of the water is obtained from the sandstone beds, which generally are hydraulically connected and act as a single aquifer. In places, however, the sandstone beds may contain water that is perched on nearly impermeable coal, siltstone, and mudstone beds. The depth to water and the altitude of the water level vary from place to place and vertically in the aquifer. The depth to water and the altitude of the water level in wells depend on the number of perched zones to which the well is open. Well yields generally range from 10 to 15 gal/min.

The water is of marginal to unsuitable chemical quality for domestic use. The sulfate and dissolved-solids concentrations generally exceed the recommended limits of 250 and 500 mg/L, respectively, in drinking water (U.S. Public Health Service, 1962). The fluoride concentration ranges from 0.1 to 2.1 mg/L. The recommended average optimum fluoride concentration for a water supply differs according to the annual average maximum daily air temperatures (U.S. Public Health Service, 1962). In the Monument Valley and the northern part of the Black Mesa areas the annual average maximum daily air temperature is about 67°F, and the optimum concentration of fluoride in drinking water is 0.9 mg/L. The presence of concentrations greater than 1.8 mg/L is grounds for rejection of the water for public supply.

ALLUVIUM

Small amounts of water are present in the alluvium along most of the larger streams. In the northern part of the Black Mesa area the wells in the alluvium are at shallow depths and are equipped with hand pumps. The alluvium is very thin and the wells may be dry in times of drought. The wells are not shown on the map. In the Monument Valley area well 8P-331 penetrates 110 ft of alluvium and yields more than 10 gal/min of water; the depth of well 8T-530 is not known. The chemical quality of the water in the alluvium is unknown.

EXPLANATION

4K-382 / 36M / 6654 / 1330 / 0.3 — WELL THAT PENETRATES THE TOREVA AND (OR) WEPO FORMATIONS—First entry, 4K-382, is well number. Second entry, 36M, is depth to water in feet below land surface (R, depth to water reported; M, depth to water measured). Third entry, 6654, is altitude of the water level in feet above mean sea level. Fourth entry, 1330, is specific conductance in micromhos per centimeter at 25°C (specific conductance is an indication of the dissolved-solids concentration in the water). Fifth entry, 0.3, is fluoride concentration in milligrams per liter

8P-331 / 55R / 5145 — WELL THAT PENETRATES THE ALLUVIUM—First entry, 8P-331, is well number. Second entry, 55R, is depth to water in feet below land surface (R, depth to water reported). Third entry, 5145, is altitude of the water level in feet above mean sea level

CHEMICAL-QUALITY PATTERN DIAGRAM—Shows major chemical constituents in milliequivalents per liter. The pattern is in a variety of shapes and sizes, which provides a means of comparing, correlating, and characterizing similar or dissimilar types of water. The pattern tends to maintain its characteristic shape as the sample becomes dilute or concentrated, and the pattern size varies in proportion to the variation in dissolved solids

APPROXIMATE AREAL EXTENT OF THE TOREVA AND WEPO FORMATIONS

ARBITRARY BOUNDARY OF GROUND-WATER AREA

BASE FROM U.S. GEOLOGICAL SURVEY
MARBLE CANYON 1:250,000, 1970 AND
SHIPROCK 1:250,000, 1969

5 0 5 MILES
5 0 5 10 KILOMETERS

CONTOUR INTERVAL 200 FEET
WITH SUPPLEMENTARY CONTOURS AT 100-FOOT INTERVALS
DATUM IS MEAN SEA LEVEL

GROUND-WATER CONDITIONS IN THE TOREVA AND WEPO FORMATIONS AND IN THE ALLUVIUM

MAPS SHOWING GROUND-WATER CONDITIONS IN THE MONUMENT VALLEY AND NORTHERN PART OF THE BLACK MESA AREAS, NAVAJO, APACHE, AND COCONINO COUNTIES, ARIZONA—1976

By

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