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Location of report area and tectonic elements in the Permian basin of western Texas and doutheastern New Mexico (modified after fig. 7, Oriel, Meyers, and Crosby, 1967, West Texas Permian basin region, in McKee, E. D., and Oriel, S. S., eds., Paleotectonic investigations of the Permian System in the United States: U.S. Geological Survey Professional Paper 515, p. 17-60).

New Mexico base from U.S. Geological Survey, Branch of Dil and Gas Operations, Roswell 9 South I inch = 2 miles (1963). Texas base from Midland Map Co. BM-2 (1969), BM-3 (1966), BM-4 (1961), BM-11 (1956), BM-12 (1956), BM-13 (1961), BM-17 (1955), and BM-18 (1955) I inch = 5,000 feet, used with permission of Midland Map Co.

A DIVISION OF NEW MEXICO INSTITUTE OF MINING AND TECHNOLOGY NEW MEXICO STATE ENGINEER RESOURCE MAP 4 104°30 103°00 LOVINGTON GAINES DENVER SADR SADR 43,000 SADR 13,000 -SADR 31,000 Proposed Injection Site SADR 3400 SADR 2900 ANDREWS CO • DLWR 9200 YTES DLWR • 140,000 0 C OUEN SADRO D D C LOVING DLWR 120,000 150,000 · RIDGE CARLSBAD 0 DLWR •110,000 • DLWR DLWR •90,000 140,000 DLWR 170,000 DLWR ANDREWS CO WINKLER CO DLWR . 23 TEXT This map was prepared to assist potential users of industrial and agricultural water in the general area of the Capitan reef located in southeastern New Mexico. It depicts the varying quality that may be available from aquifers in the Guadalupian Series. Water containing relatively high concentrations of chloride ions (10,000 to more than 150,000 milligrams per liter) is found in rocks of the Guadalupian Series on the Northwest Shelf northwest of Hobbs, New Mexico, on the Central Basin platform, and in the Delaware basin. Conversely, water containing relatively low chloride-ion concentrations (less than 10,000 milligrams per liter) is associated with the Capitan parties. RED BLUFF DLWR 120,000 DLWR 82,000 DLWR 26,000 • milligrams per liter) is associated with the Capitan aquifer, the San Andres Limestone, and the Artesia Group along the margins of the Delaware basin and at the north and south ends of the Central Basin platform. Fingers of the best quality of water extend into the Capitan aquifer to the north and east from the Guadalupe Mountains, New Mexico, and to the north away from the Glass Mountains, Texas. The quality of ground water found in rocks of the Guadalupian Series in the western part of the Permian basin is primarily controlled by hydraulic conductivity of the aquifer and the proximity to the outcrop which is present in the western and southern part of the basin. Leaching of soluble minerals from the Guadalupian Series at the surface has enhanced the hydraulic conductivity where these rocks are exposed west of the Pecos River on the Northwestern shelf and in the Guadalupe Mountains. Fresh water enters the Guadalupian Series at outcrops in the Guadalupe, Delaware, Apache, and Glass Mountains, and at other exposures along the western and southern edges of the Permian basin. The fresh water has replaced saline water in the aquifer in amounts proportional to the hydraulic conductivity of the aquifers that have been developed by leaching of the strata. Relatively fresh water may be found resting upon saline water, as in the general case west of the Pecos River between Artesia and Carlsbad, or it may be encountered in situations where it is overlain and (or) surrounded by more saline water as, for example, in the vicinity of Carlsbad and in the San Andres Limestone and Grayburg Formation south of Hobbs, New Mexico. Throughout the area, water with a relatively low salinity can be found inter-fingering with water that is relatively high in salinity. This relationship has been shown to be a dependable qualitative indicator of the relative differences in hydraulic conductivity of the rocks. he quality of ground water found in rocks of the Guadalupian Series in the western part of DLWR 28,000 DLWR 7100 he data were obtained from many sources including various exploration, production, and service companies within the petroleum industry and State and Federal agencies. The analyses represent samples of water collected over a period of approximately 45 years from 1926 to 1971 but are believed to accurately depict, on a regional basis, the water now 160,000 present in the Permian (Guadalupian) age sedimentary rocks. he two examples below illustrate use of the map. Water containing less than 5,000 milli-grams per liter chloride is available near Carlsbad, in an arcuate strip parallel to the Capitan aquifer, and in narrow bands at either end of the Central Basin platform. By closer examination of the data points, the individual aquifers that would contain water of this quality can be identified from the plotted data points. On the other hand, an exploration for concentrated brines would be restricted to areas where the Guadalupian rocks are known to contain nearly saturated brines, as in the Delaware Mountain Group in BARSTOW eastern Loving County, Texas. **EXPLANATION** Approximate position of extreme shelfward edge Position of Capitan aquifer DLWR DLWR 550000 ine of equal chloride-ion concentration, in thousands of milligrams per liter. Dashed where inferred. Based on lowest concentration shown or interpreted to be present. Within any area delineated by two lines, ground water having a chloride-ion concentration indicated by the line values is probably present in at least one water-bearing zone; ground water having a higher chloride-ion concentration than that indicated by the contour values is generally present also. DLWR 120,000 • DLWR 140,000 Stratigraphic code representing -Well penetrating sediments of name of the formation from which water sample has been collected. The stratigraphic codes are Permian (Guadalupian) age YTES -DLWR •160,000 SADR YTES 980 8100 listed in order of stratigraphic position, highest first \angle 12,000 \rightarrow Chloride-ion concentration 140,000 YIES* Multiple sample taken from same formation DLWR •180,000 Stratigraphic Codes SADR 930 Name (all units are of Permian age) Capitan aquifer Delaware Mountain Group KENT DLWR GBSA Grayburg Formation-San Andres Limestone undivided Grayburg Formation Queen Formation GRBG QUEN San Andres Limestone Seven Rivers Formation 74,000 BY Tansill Formation Yates Formation NORTHWESTERN SHELF AND CENTRAL BASIN PLATFORM FORT. STOCKTON YTES 5200 NEW MEXICO TEXAS Madera Min MOUNTAINS MARFA pproximate position of Capitan aquifer

> CHLORIDE-ION CONCENTRATION IN GUADALUPIAN ROCKS, SOUTHEAST NEW MEXICO AND WEST TEXAS by W. L. HISS

MARATHON

103°00'

103°30'

Figure 3