Magnesium plus Calcium to Bicarbonate

The areal distribution of the milliequivalent ratio of magnesium plus calcium to bicarbonate ($MgCa:HCO_3$) in water from the lower Claiborne-upper Wilcox aquifer shows that the ratio ranges from less than 0.01 near the downdip limit of the data in southern Texas and western Mississippi to 33.3 in the outcrop area of central Arkansas (table 1). The $MgCa:HCO_3$ ratio decreases from the outcrop to the downdip limit of the data (fig. 17).

From the Sabine uplift eastward to southwestern Alabama the $MgCa:HCO_3$ ratio ranges from about 0.50 to greater than 1 in the outcrop area and from less than 0.10 to about 0.50 in the area from the outcrop to the downdip limit of the data. From the Sabine uplift southwestward to the San Marcos arch the *$MgCa:HCO_3$ ratio ranges from 0.10 to about 5. Generally the* larger ratios are updip and along the outcrop area whereas the smaller ratios are mostly downdip and near the downdip limit of the data. From the San Marcos arch southwestward to the Rio Grande the $MgCa:HCO_3$ ratio ranges from less than 0.10 in most areas near the downdip limit of the data to greater than 1 in updip and outcrop areas.

Magnesium plus Calcium to Sodium plus Potassium

The areal distribution of the milliequivalent ratio of magnesium plus calcium to sodium plus potassium ($MgCa:NaK$) in water from the lower Claiborne-upper Wilcox aquifer shows that the ratio ranges from less than 0.01 in west-central Mississippi and southern Texas to 14 in northeastern Arkansas (table 1). The $MgCa:NaK$ ratio generally decreases from the updip and outcrop areas to the downdip limit of the data except in eastern Texas near the Sabine uplift where it appears to increase from the outcrop to the downdip limit of the data (fig. 18).

From the Sabine uplift eastward to southwestern Alabama the $MgCa:NaK$ ratio generally ranges from 1 to 5 in the outcrop area and from 0.01 in west-central Mississippi to 10 in northeastern Arkansas in the area from the outcrop to the downdip limit of the data. From the Sabine uplift southwestward to the Trinity River the ratio increases from about 0.10 in an area between the updip limit and the Sabine uplift to about 5 in an area southwest of the Sabine uplift near the downdip limit of the data. From the Trinity River southwestward to the San Marcos arch the ratio decreases from about 1 updip to about 0.10 near the downdip limit of the data. From the San Marcos arch southwestward to the Rio Grande the ratio generally ranges from 1 to 5 in the outcrop and updip areas to less than 0.10 near the downdip limit of the data.

Bicarbonate to Sulfate

The areal distribution of the milliequivalent ratio of bicarbonate to sulfate ($HCO_3:SO_4$) in water from the lower Claiborne-upper Wilcox aquifer shows that the ratio ranges from 0.08 along the outcrop in eastern Texas to 3,310 near the downdip limit of the data in west-central Mississippi (table 1). The $HCO_3:SO_4$ ratio increases from the outcrop to the downdip limit of the data in the areas extending from the Sabine uplift eastward to southwestern Alabama and from the Brazos River southwestward to the Rio Grande (fig. 19).

From the Sabine uplift eastward to southwestern Alabama the $HCO_3:SO_4$ ratio ranges from more than 1 to about 100 in the outcrop area and from about 5 to more than 500 in the middip and downdip areas. From the Sabine uplift southwestward to the Brazos River the $HCO_3:SO_4$ ratio ranges from about 1 in an outcrop area northwest of the Sabine uplift to more than 100 in an area adjoining the northwestern side of the Sabine uplift. From the Brazos River southwestward to the Rio Grande the $HCO_3:SO_4$ ratio increases from about 5 updip to more than 100 near the downdip limit of data.

Bicarbonate to Chloride

The areal distribution of the milliequivalent ratio of bicarbonate to chloride ($HCO_3:Cl$) in water from the lower Claiborne-upper Wilcox aquifer shows that the ratio ranges from 0.02 in east-central Louisiana near the downdip limit of the aquifer to 269 in central Mississippi (table 1). However, lines of equal concentration were not extended into the area of the lower range of the concentration because it was the only data point in a very large area of the the aquifer. In the area mapped the $HCO_3:Cl$ ratio appears to be largest in the middip areas and to decrease from western Mississippi southwesterly to southern Texas (fig. 20).

From the Sabine uplift eastward to southwestern Alabama the $HCO_3:Cl$ ratio ranges from about 5 to about 30 in the outcrop area and from about 1 to more than 50 in the area from the outcrop to the downdip limit of the data. The $HCO_3:Cl$ ratio is greater than 50 in an area that incompasses the common borders of Arkansas, Tennessee, and Mississippi and an area that is located in central Mississippi. From the Sabine uplift southwestward to the San Marcos arch the $HCO_3:Cl$ ratio generally ranges from 1 to 5 in the outcrop along the northern side of the study area and 5 to 20 in the outcrop around the edge of the Sabine uplift. From the outcrop to the downdip limit of the data the $HCO_3:Cl$ ratio generally ranges from 5 to 20 between the Sabine uplift and the Brazos River and 1 to 5 between the Brazos River and the San Marcos arch. From the San Marcos arch southwestward to the Rio Grande the $HCO_3:Cl$ ratio ranges from about 1 to less than 5 in the outcrop area and from about 1 to more than 5 in the area between the outcrop and the downdip limit of the data.

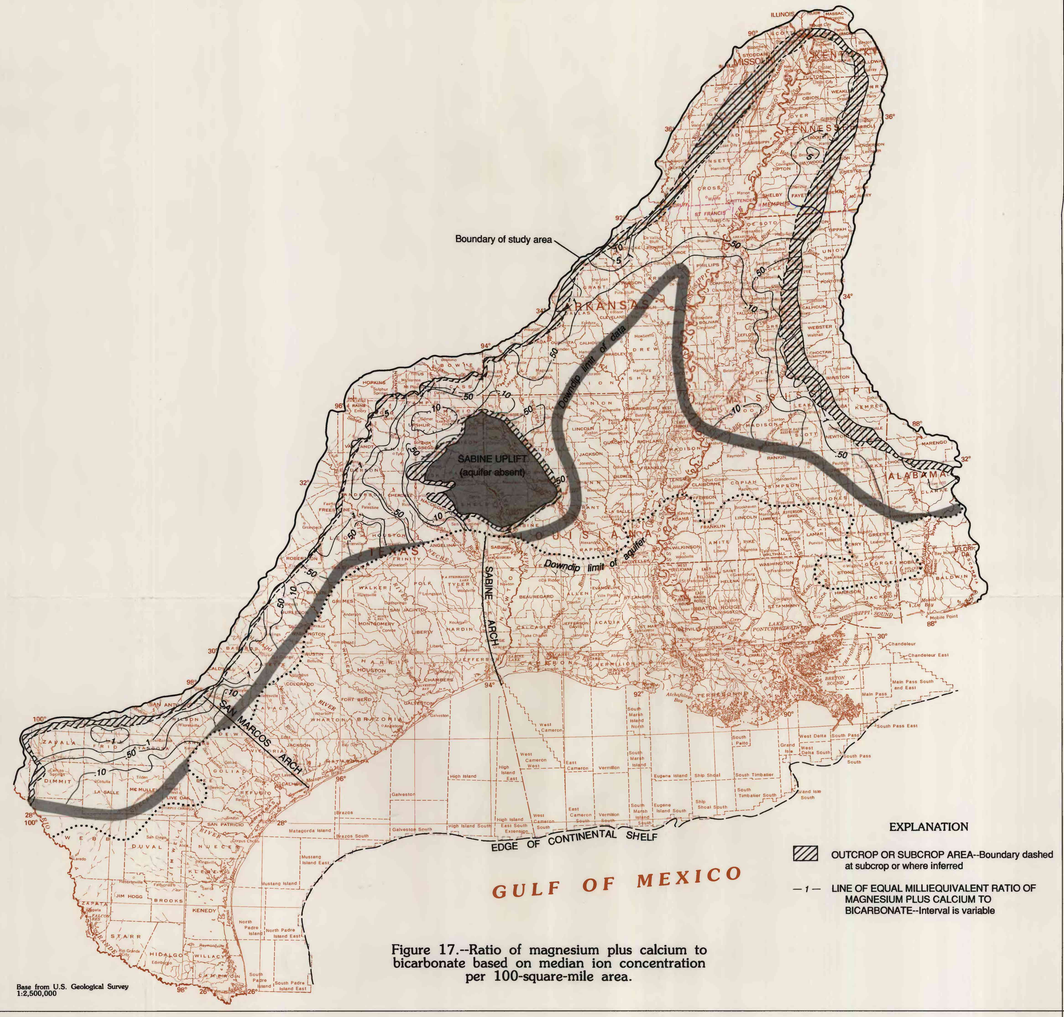

Figure 17.--Ratio of magnesium plus calcium to bicarbonate based on median ion concentration per 100-square-mile area.

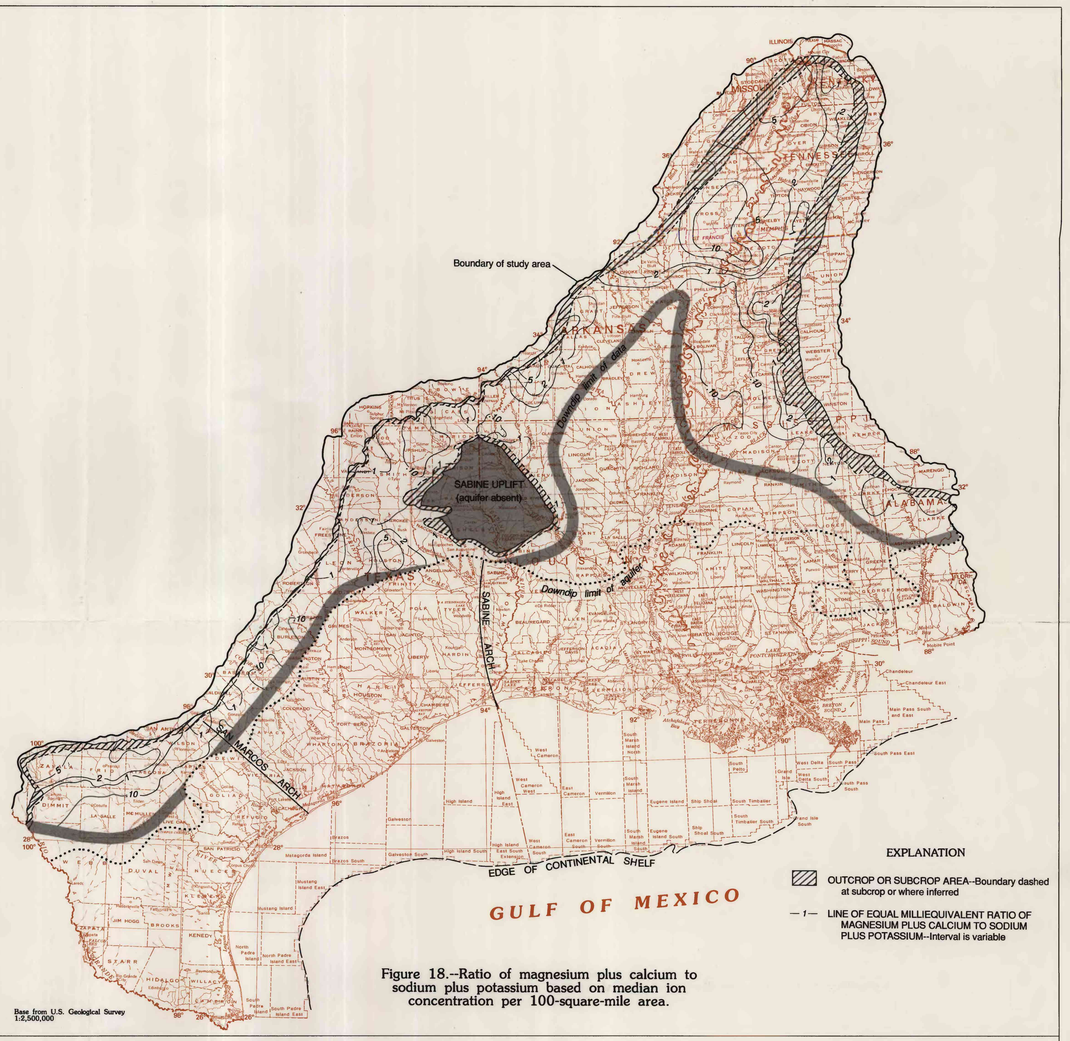

Figure 18.--Ratio of magnesium plus calcium to sodium plus potassium based on median ion concentration per 100-square-mile area.

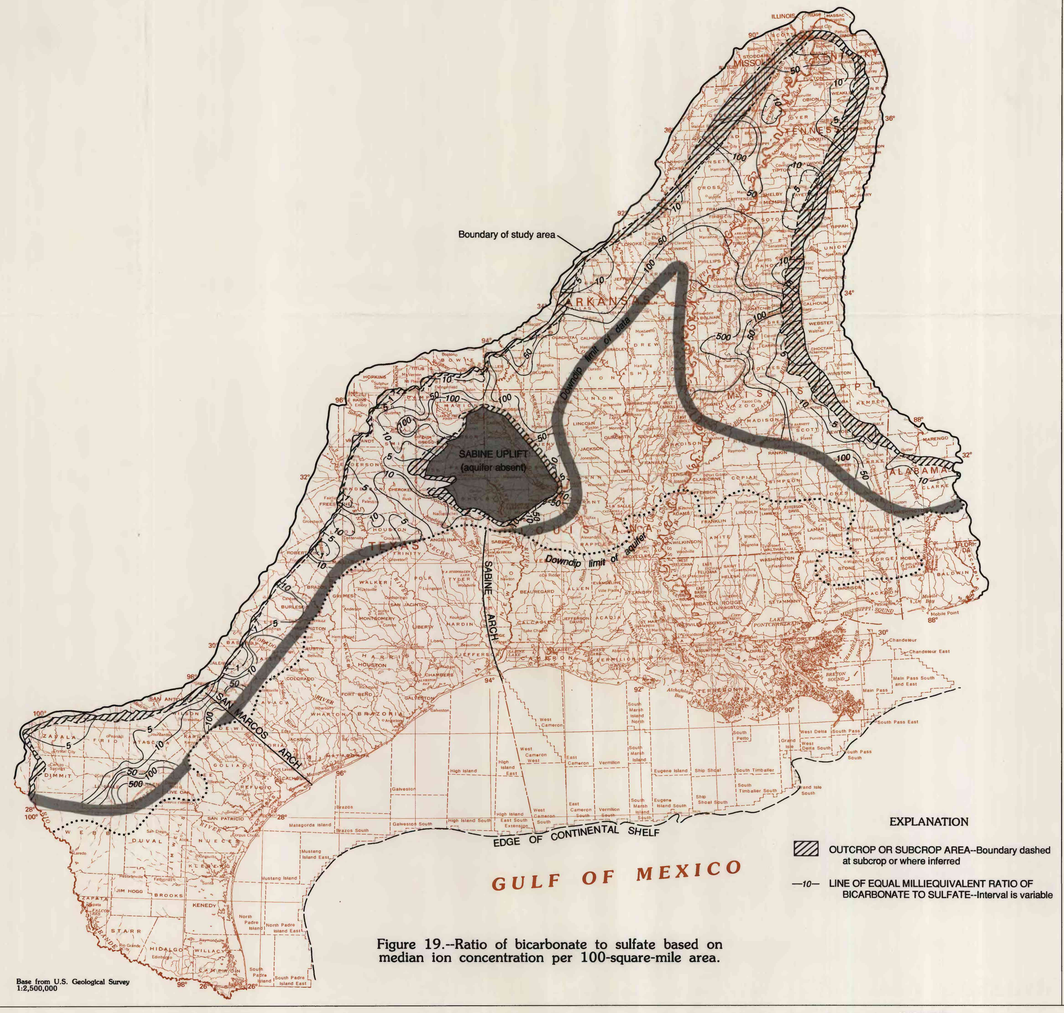

Figure 19.--Ratio of bicarbonate to sulfate based on median ion concentration per 100-square-mile area.

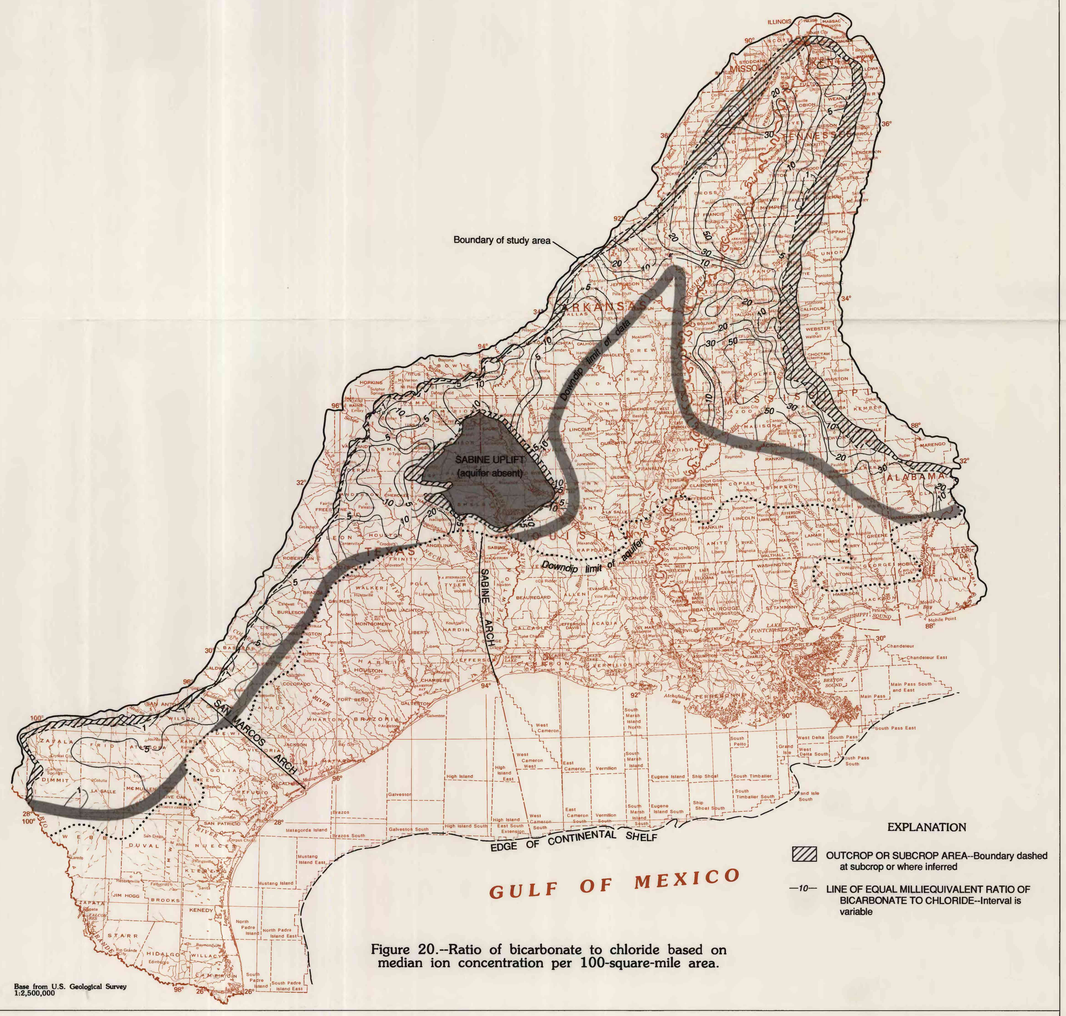

Figure 20.--Ratio of bicarbonate to chloride based on median ion concentration per 100-square-mile area.

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PROPERTIES AND CHEMICAL CONSTITUENTS IN GROUND WATER FROM THE LOWER CLAIBORNE-UPPER WILCOX AQUIFER, GULF COAST REGIONAL AQUIFER SYSTEMS, SOUTH-CENTRAL UNITED STATES

by

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