

Hydrogeologic Study of the Mimbres Basin Aquifer System - A Transboundary Multi-use Aquifer

(Related to Urban Areas, Agriculture, and Open Space)



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ABOUT ME



OVERVIEW

- Description of the Mimbres Basin
- Purpose and Research Objectives
- Sampling & Collection Methods
- Parameters Measured
- Results
- Impact & Importance
- Future Research



STUDY AREA - MIMBRES BASIN

- Interconnected group of geohydrologic sub-basins that cover about 13,300 km²
 - Includes part of United States and Mexico
- Represents a wide array of land use/land cover
 - Forests (in higher elevations in the north)
 - Rangeland (accounts for majority of the area)
 - Lowlands (mix of irrigated farmland, rangeland, and alkali-flats)
 - Irrigated cropland (mainly located south of Deming along the Mimbres River. Crops are chile, cotton, and small grains.)



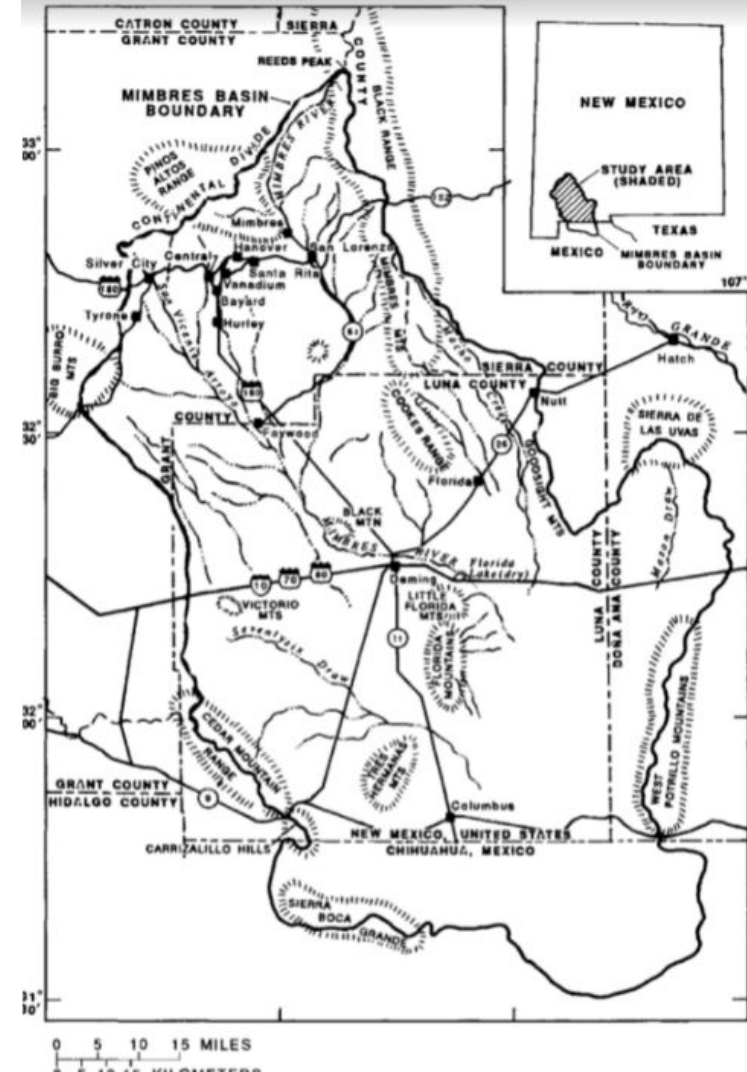
MOTIVATION

- Use of Environmental Isotopes for regional analysis (never before done in this area)
- Provides new and updated groundwater data for a growing urban and existing agriculture area shared by the United States and Mexico
- 5-year study using major inorganic constituents and trace elements along with the environmental isotopes



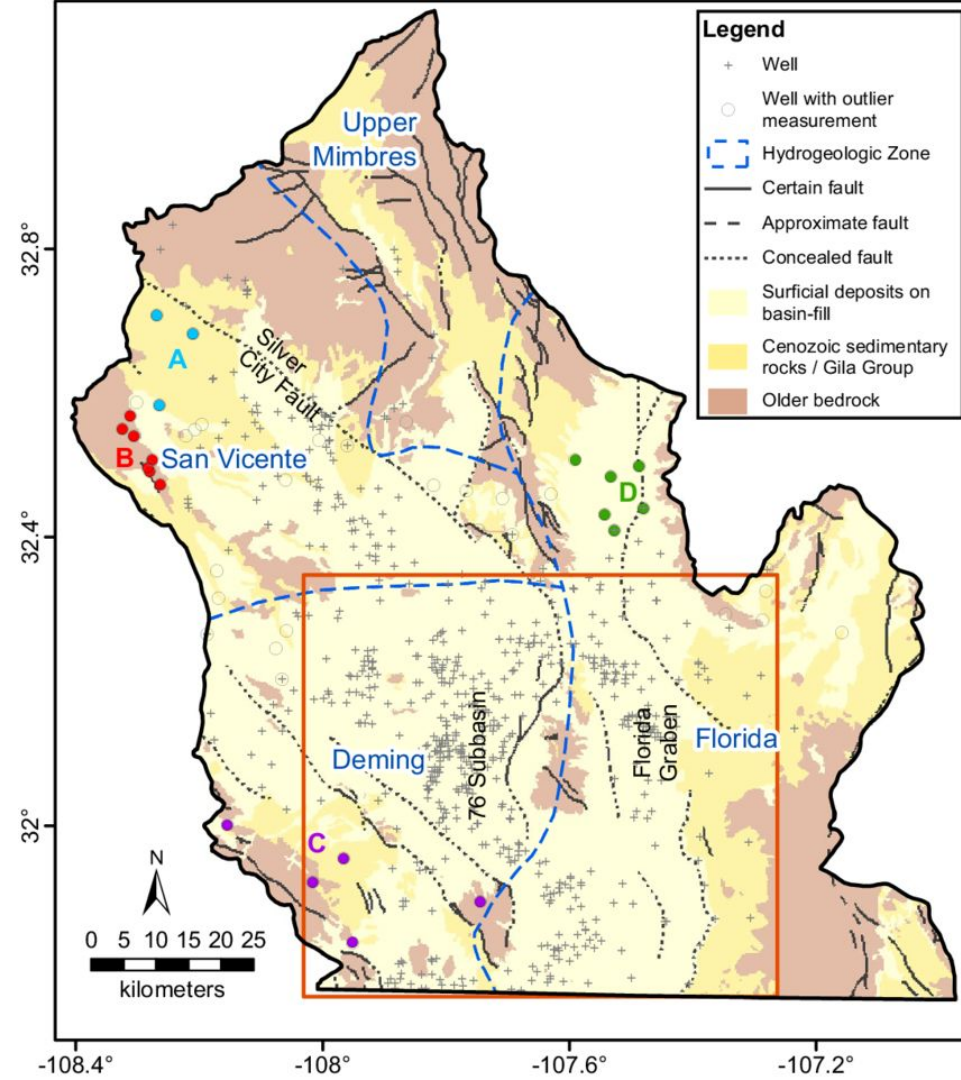
PURPOSE OF RESEARCH

- Perform a hydrogeologic/isotopic/hydrochemical study of the Transboundary Mimbres Basin Aquifer System
 - This large binational aquifer system lacks isotopic and specialized isotopic data on a regional scale
 - Investigate ways to fill this data vacuum

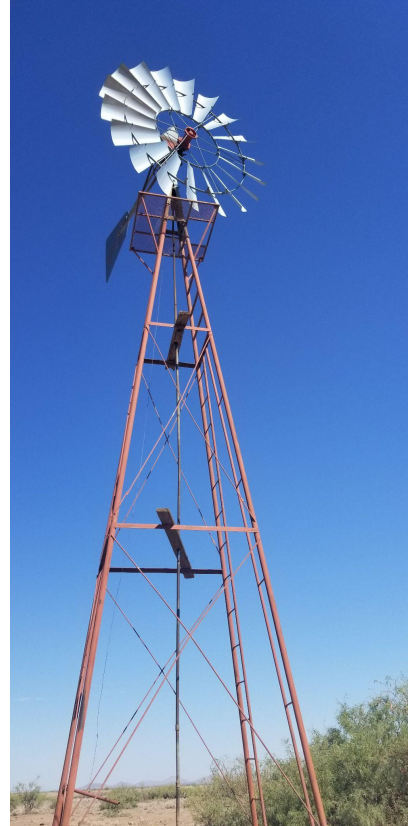


RESEARCH OBJECTIVES

- Age-date groundwater
- Confirm modern groundwater flowpaths and map out possible paleo-groundwater flowpaths
- Map out areas of modern groundwater recharge
- Determine areas where pluvial groundwater is in storage in aquifer sub-basins
- Determine mechanisms of groundwater salinization



METHODS - PRECIPITATION COLLECTORS AND WELL SAMPLES



PRECIPITATION COLLECTORS

- Simple, inexpensive devices designed to collect rainfall at a given location.
- Every three months, the collection bottle is removed and returned to the lab where a stable isotope sample of the rainfall is collected



METHODS USED TO COLLECT WELL SAMPLES

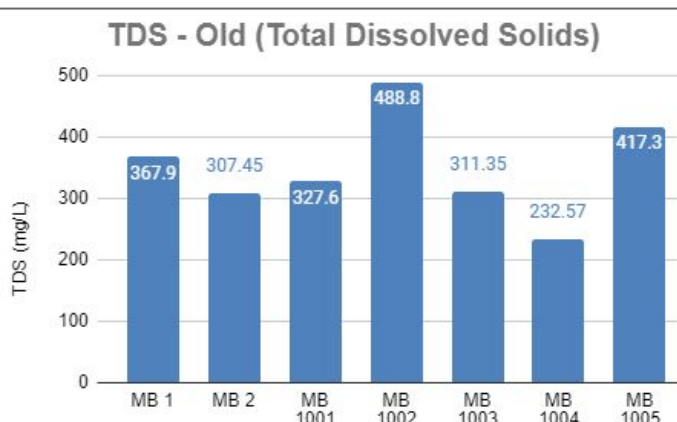


PARAMETERS MEASURED

- (Index Field Parameters) **pH, Conductivity, Temperature, Dissolved Oxygen, and Oxidation Reduction Potential** – measured at the wellhead/stream
- General Minerals (**example: Chloride, Sodium**)
- Trace Elements (Large suite of trace elements – **example: Arsenic, Selenium, Lithium, and Chromium**)
- Environmental Isotopes (**Carbon 14, Tritium, and Stable Isotopes of O, H, C, S.**)



Multi parameter sonde



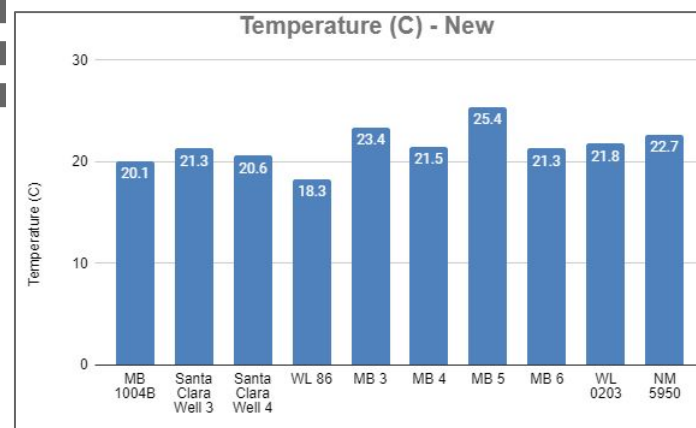
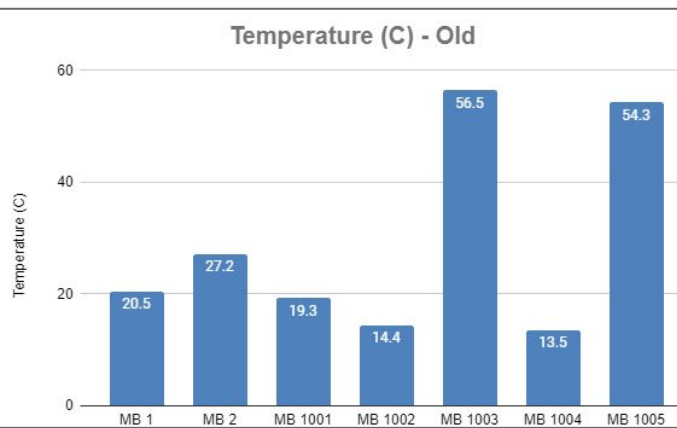
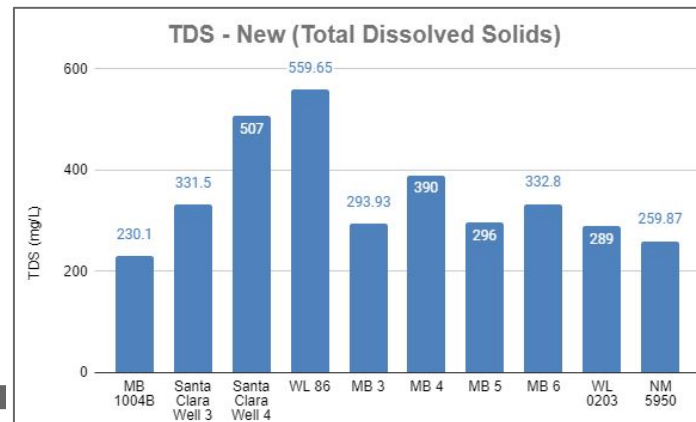
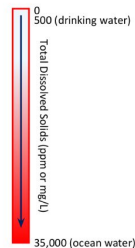
TOTAL DISSOLVED SOLIDS (TDS)

Total Dissolved Solids (TDS)

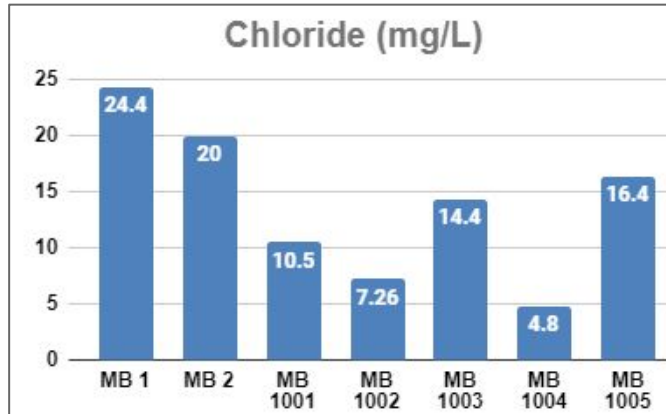
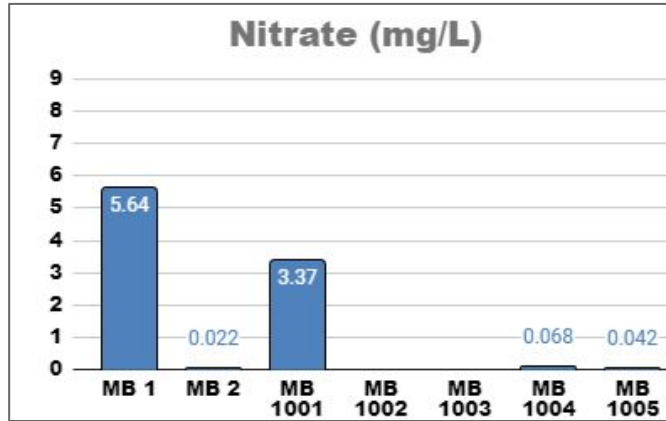
TDS – Dissolved Minerals

Water Supply Scheme

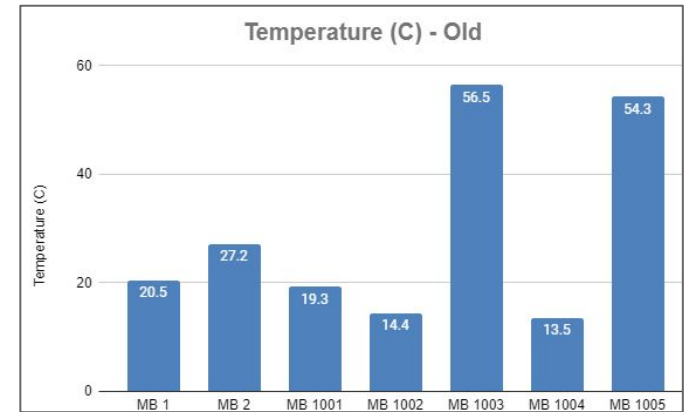
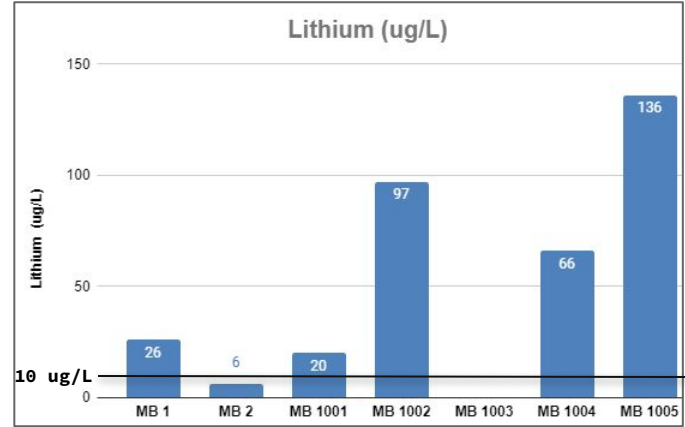
Class	TDS (mg/L)
Fresh	0 – 1000
Slightly Saline	1000 – 3000
Moderately Saline	3000 – 10,000
Very Saline	10,000 – 35,000
Brine	> 35,000



NITRATE, CHLORIDE, AND LITHIUM

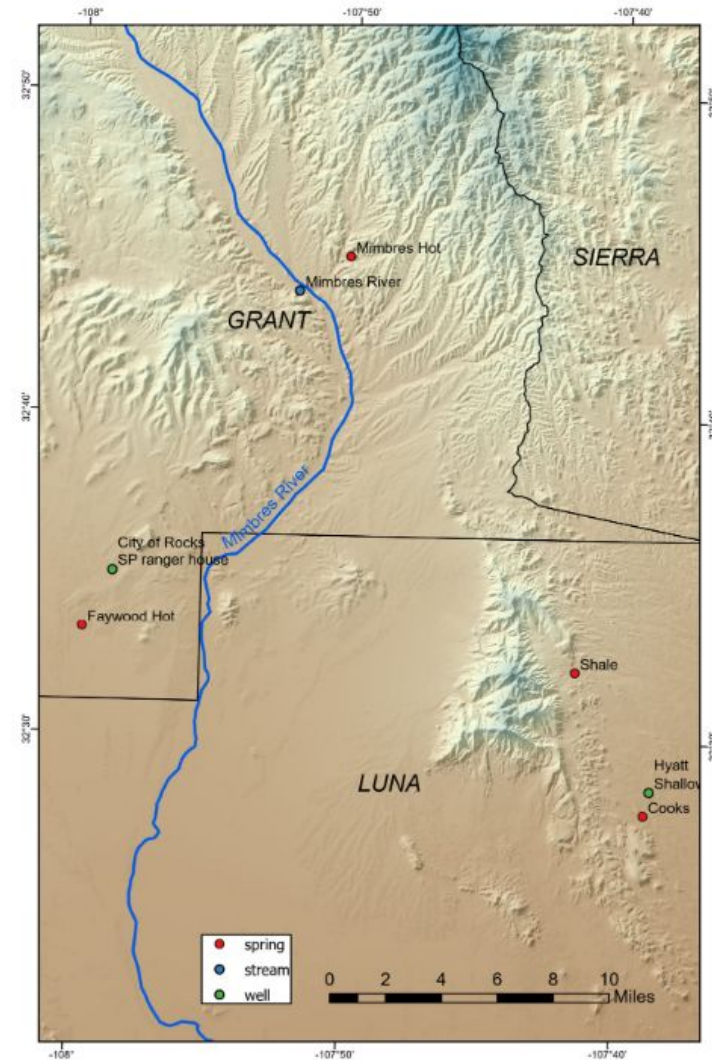


- **Nitrate:**
Standard is 10 mg/L
- **Chloride:**
Standard is 250 mg/L
- **Lithium:**
Concentrations above 10 ug/L may be unhealthy



RESULTS

- **TDS** - All samples within the range of “Fresh” (0-1000 mg/L)
- **Nitrate and Chloride** - All samples below the EPA standard
- **Lithium** - All but one sample is under the EPA “health reference level”



RESEARCH IMPACT & IMPORTANCE

- Accurate data regarding well water composition is essential in transboundary, multi-use aquifers like Mimbres
- Communities rely on well water for agriculture, livestock, domestic use, and drinking water
- TDS – High salinity creates negative outcomes
- Year-one baseline data informs the next phase of studies of aquifers and salinity evolution

FUTURE RESEARCH

- Continuation of this five-year study to cover a range of isotopic/hydrochemical analysis, while providing a formative contribution to our understanding of transboundary Mimbres Basin Aquifer System.
- Projects will include at least 4 more REEU students & continue each summer for 4 years.
- Subsequent journal publications and report to area stakeholders.

Map Showing Sulfate In Wells

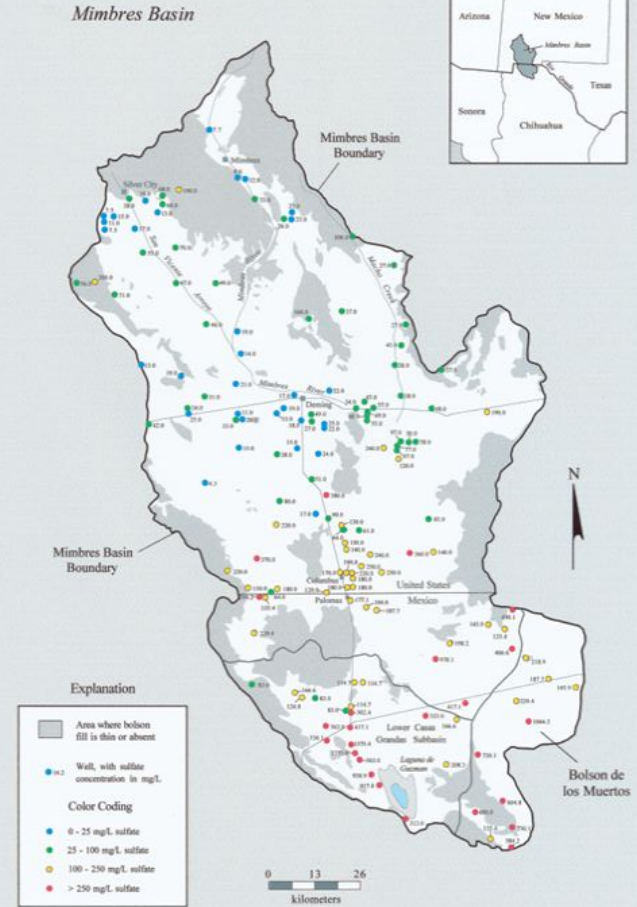


Figure 4-9. Map for the Mimbres Basin, and associated basins, showing sulfate concentrations in water wells color coded by range (source of data: U.S. Geological Survey; Comision Nacional Del Agua; Instituto Nacional de Estadística, Geografía e Informática).

IMPACT OF THE INTERNSHIP

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QUESTIONS?





THANK YOU!

