

## Hydrogeochemical Analysis of Wells in Cedarville, Ohio

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# Hydrogeochemical Analysis of Wells in Cedarville, Ohio

Audrey Illig, Thomas Rice, Department of Science and Mathematics  
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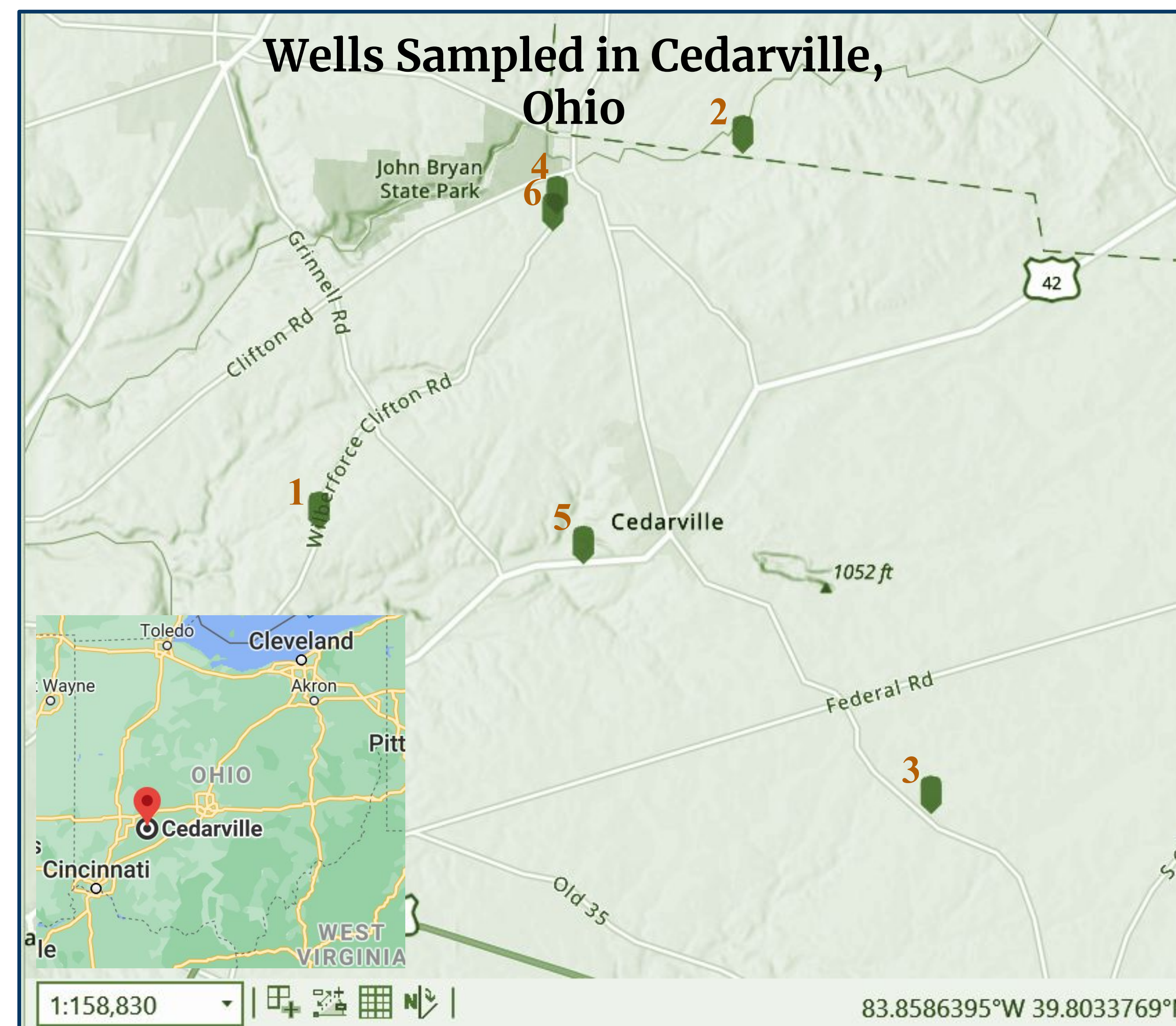


## Introduction

The water we drink is influenced by its environmental surroundings. This study focuses on the geological and chemical elements that surround and influence six water wells local to Cedarville, Ohio. This study includes a brief overview of the historical geological bedrock of the area as well as a chemical analysis on the common cations and anions found in the water samples from these wells.

## Objective

This study was conducted in order to correlate hydrological, geological, and chemical data. By doing so, a better understanding of how the two relate to and influence each other can be achieved. An additional outcome of this study is to ensure that the chemical makeup of the water in the six observed wells is safe and healthy for residential intake and use.



Aerial view of the location of the six wells under observation for this study.  
Map constructed on Esri's ArcGIS Pro by Audrey Illig

## Results

Well	Cation/Anion Avg. Difference Based on Lab Results	Geological Background According to the Macrostat Lab, Dept of Geoscience, University of Wisconsin	Web Soil Survey Information	pH	Elevation (ft above avg. sea level)	Measured Depth from Ground Surface to Water Level (ft)	Approximate Water Level in Well Above Sea Level (elevation - depth from ground surface to water level)
1	3.45%	Cedarville dolomite, Springfield dolomite, Euphemia dolomite, overlies Massies shale	100% Miamian silt loam	7.1	1,033 ft	20.16 ft	1,012.84 ft
2	3.48%	Cedarville dolomite, Springfield dolomite, Euphemia dolomite, overlies Massies shale	100% Ockley silt loam	6.9	1,018 ft	20.64 ft	997.36 ft
3	4.48%	Dolomite, thin to massive bedded, upper 2/3 shale laminae, lower 1/3 brecciated	23.2% Ragsdale silty clay loam 76.8% Reesville silt loam	6.8	1,066 ft	20.14 ft	1,045.86 ft
4	2.6%	Cedarville dolomite, Springfield dolomite, Euphemia dolomite, overlies Massies shale	19.5% Ragsdale silty clay loam 80.5% Xenia silt loam	6.9	1,029 ft	7.83 ft	1,021.17 ft
5	5.89%	Cedarville dolomite, Springfield dolomite, Euphemia dolomite, overlies Massies shale	29.5% Miamian silt loam 48.4% Miamian clay loam 22.1% Russell-Miamian silt loam	6.9	1,024 ft	61.79 ft	962.21 ft
6	5.54%	Cedarville dolomite, Springfield dolomite, Euphemia dolomite, overlies Massies shale	40.7% Fincastle silt loam 6.7% Ragsdale silty clay loam 52.5% Xenia silt loam	6.8	1,043 ft	13.6 ft	1,029.40 ft

## Methods

### Field Data Collection:

- Wells were purged for several minutes before sampling
- Water samples from each well were collected in bottles; any additional conduits (i.e. hoses) were removed and precautions were taken to prevent any outside influences from contaminating the sample
  - Two of the four bottles contained no preservatives
  - One bottle contained Nitric Acid
  - One bottle contained Sulfuric Acid
- Water levels were measured within the well
- pH was measured from water samples
- Samples were sent to the Montgomery County Environmental Lab where they were tested for the following constituents\*:



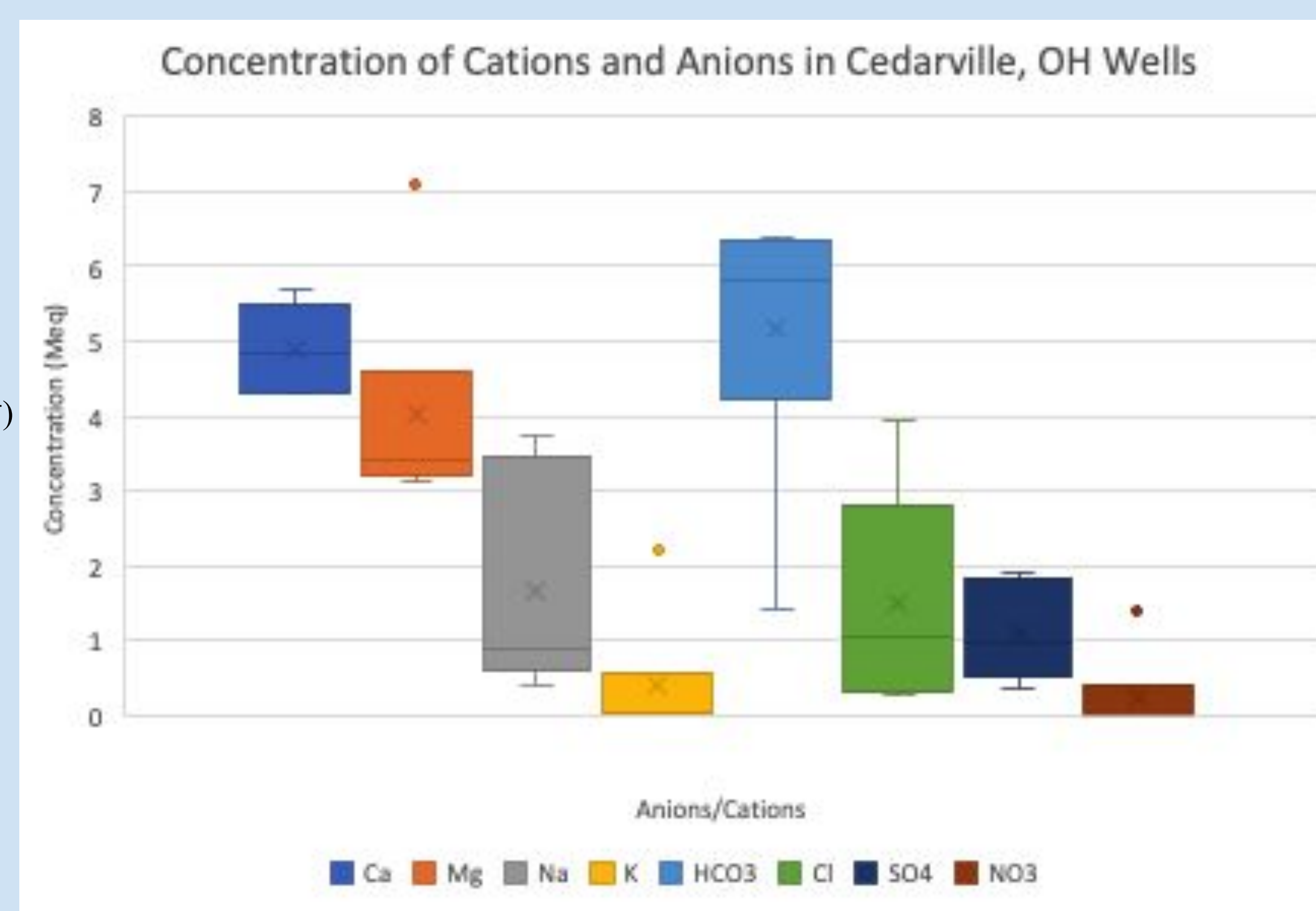
### Cations

- Calcium (Ca<sup>+</sup>)
- Iron (Fe<sup>+</sup>)
- Magnesium (Mg<sup>+</sup>)
- Manganese (Mn<sup>+</sup>)
- Potassium (K<sup>+</sup>)
- Sodium (Na<sup>+</sup>)

### Anions

- Chloride (Cl<sup>-</sup>)
- Nitrate-Nitrite (NO<sub>3</sub><sup>-</sup>/NO<sub>2</sub><sup>-</sup>)
- Sulfate (SO<sub>4</sub><sup>2-</sup>)
- Bicarbonate (HCO<sub>3</sub><sup>-</sup>)

\*Note: chemical components of the water samples may not be limited to these ten constituents



Statistical analysis and graph completed by Lydia Bradley

## Conclusions

**Major takeaways:** The Cedarville dolomite, Springfield dolomite, and Euphemia dolomite areas had similar soils overlying them; many were composed of the Miamian silt loam, and all were contained some type of silt loam. There does not appear to be a strong correlation between soil composition and the chemical makeup of the water in these six wells.

**Important to note:** Well #3 was an outlier for Potassium cations content. Whereas the other wells had 1.5 mg/L or less of Potassium cations, this well had 15.9 mg/L. This could have been a measurement error in the lab testings, or it could be indicative of unique geological and chemical conditions in the environment around the well. The latter could be a viable explanation as this well does have a geologic background different than the others, as seen in the chart above.

**Further study:** All six of these wells are located in rural areas commonly used for agricultural purposes; therefore, a study on the effect of biological elements in the environment on the chemical content of the groundwater could be beneficial. A closer look at the influence of the underlying geological features and formations is recommended as well.

