

Figure 4.--Calcium

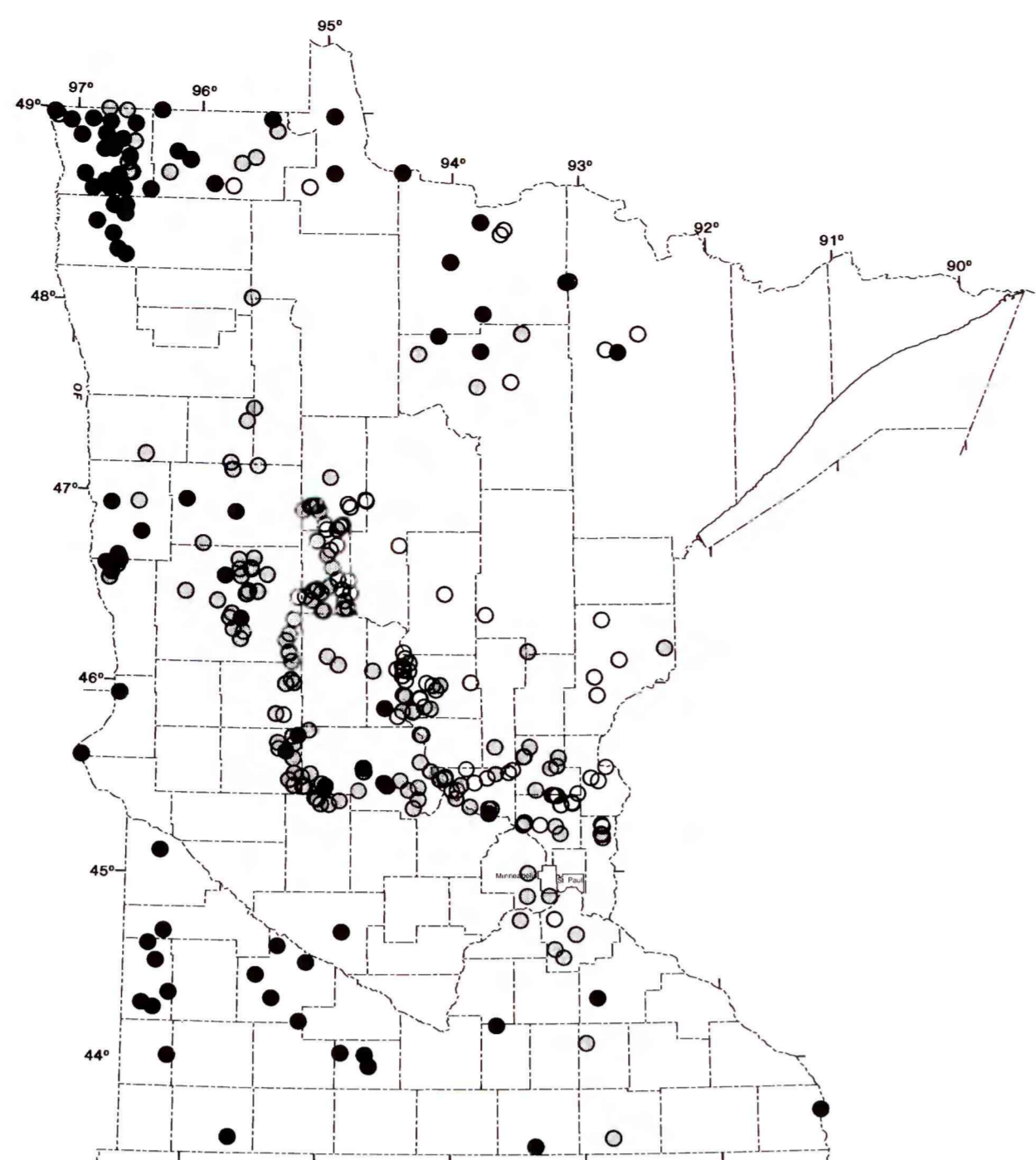


Figure 5.--Magnesium

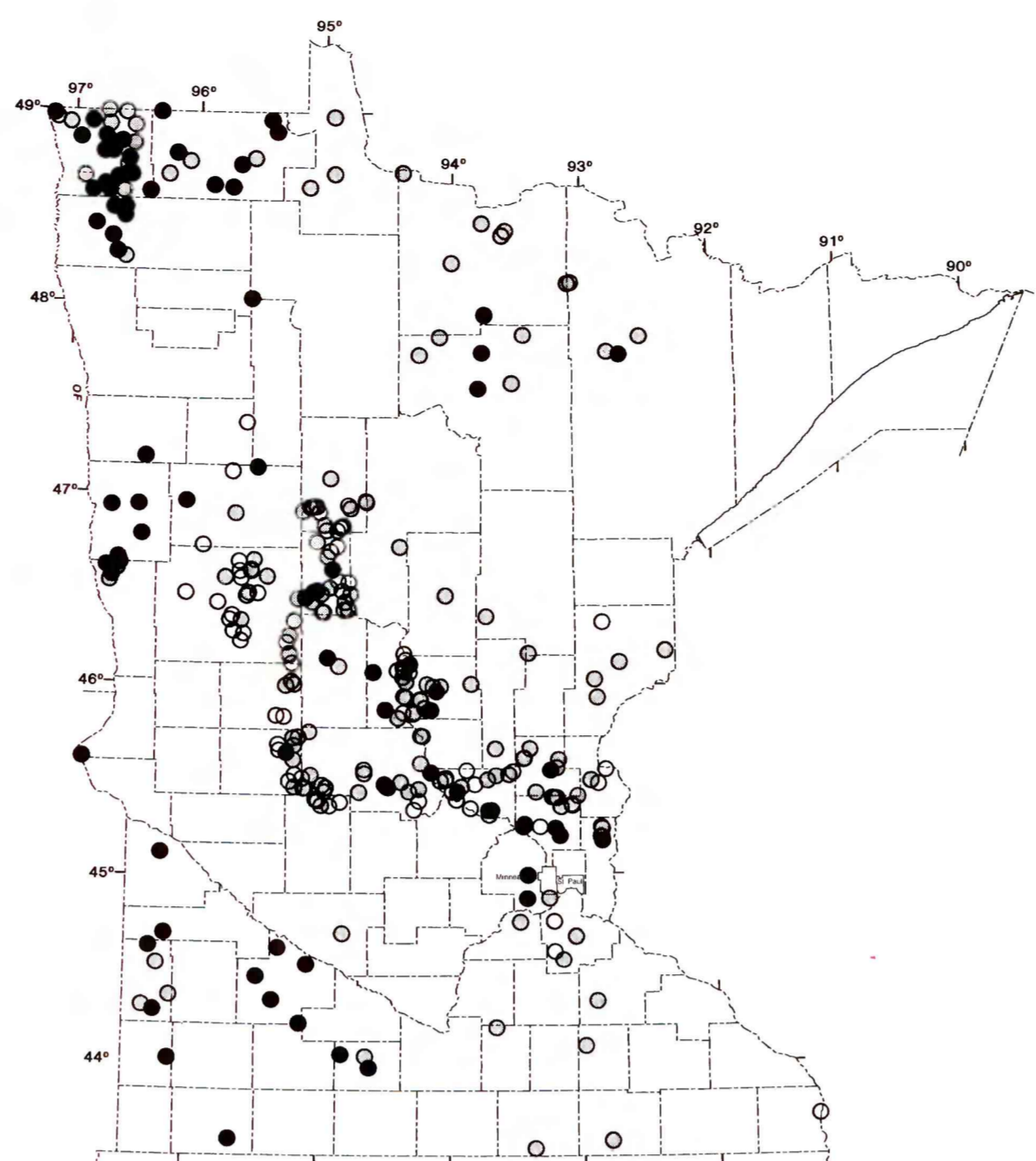


Figure 6.--Sodium

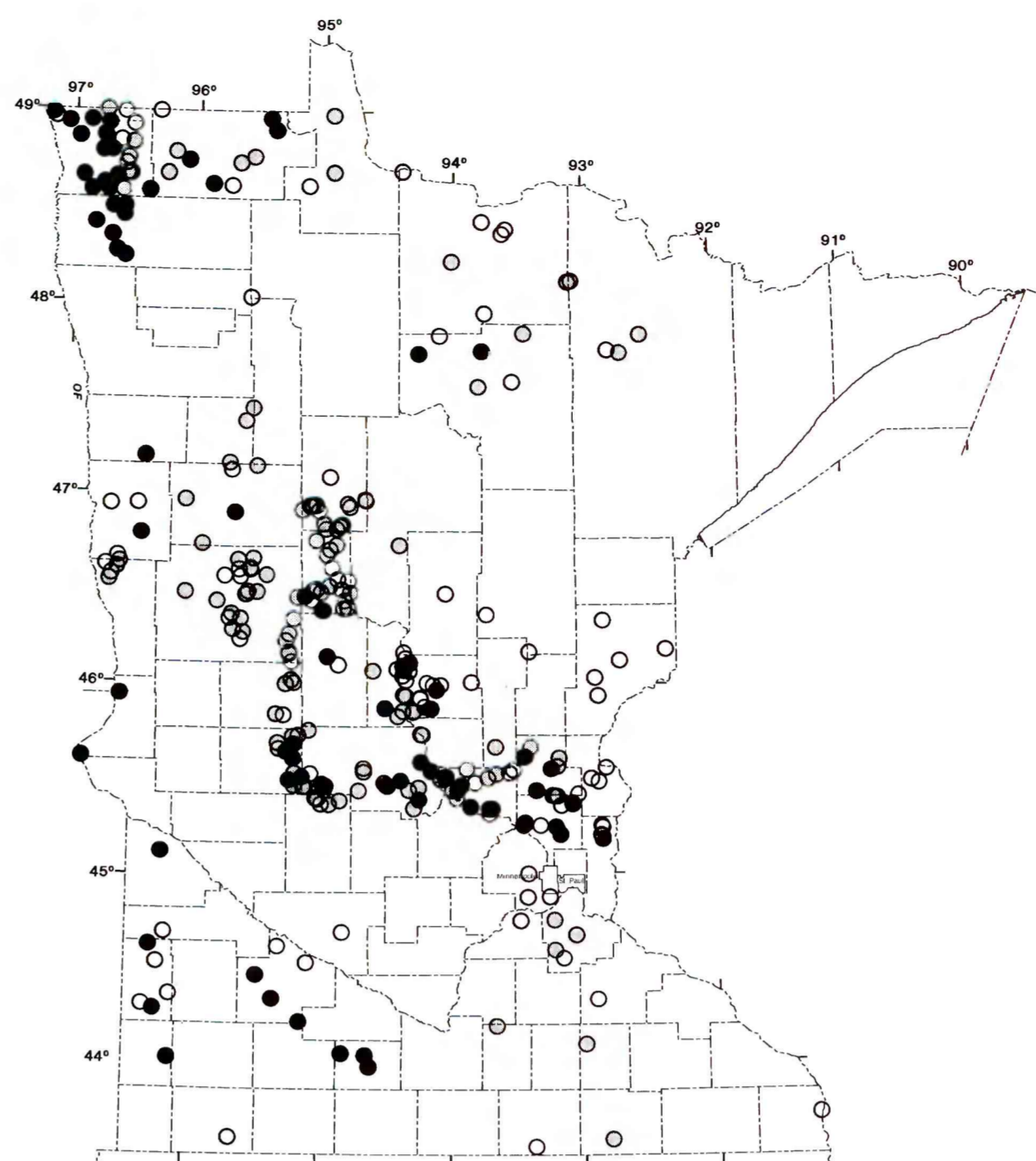


Figure 7.--Chloride

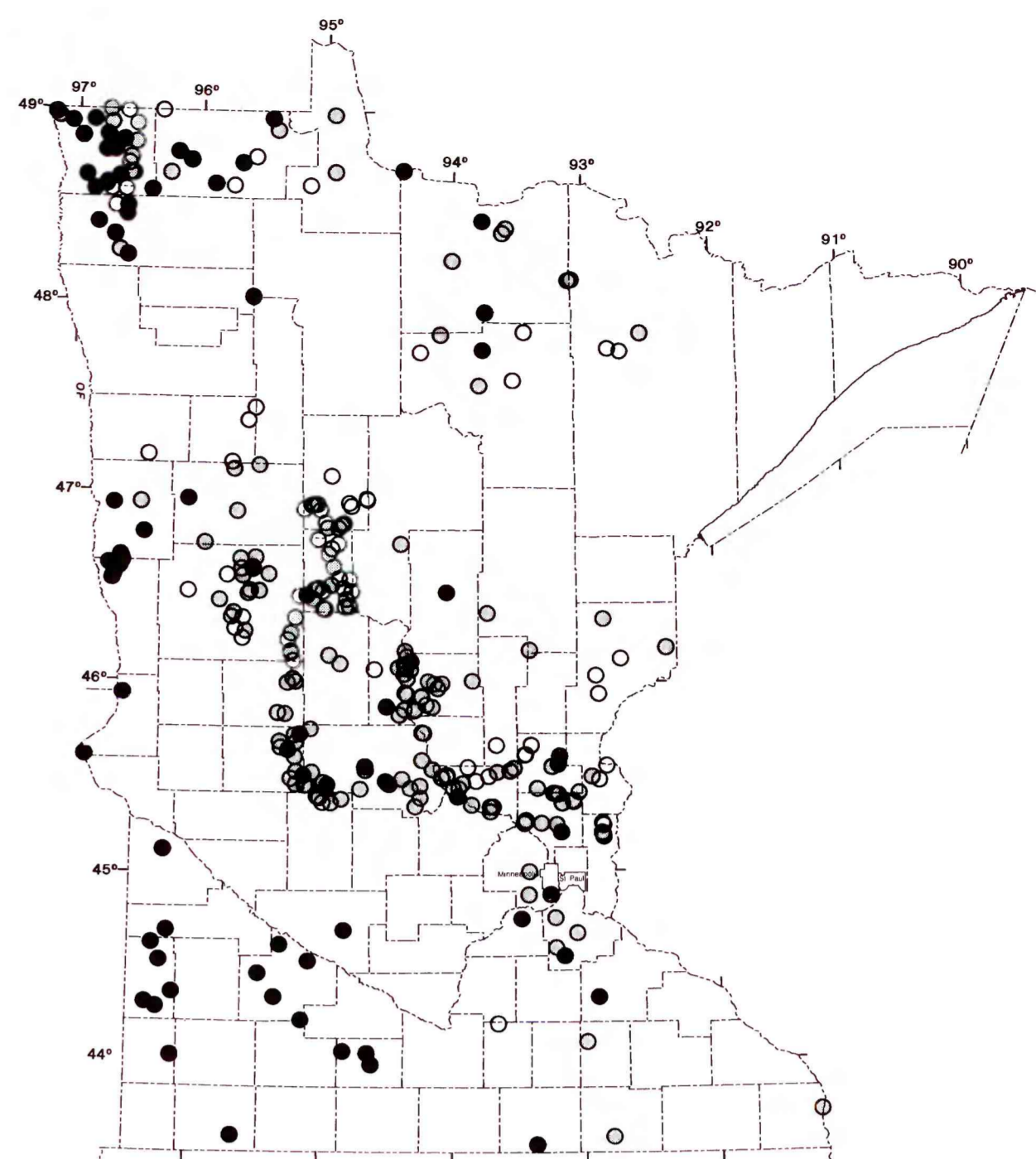


Figure 8.--Sulfate

**SHALLOW-DRIFT WATER QUALITY**

Variation of Major Water-Quality Constituents

Tables 1 and 2 show that mineralization in the deep drift generally is greater than in the shallow drift. Median values for the concentrations of dissolved solids and of the major ions calcium, magnesium, sodium, sulfate, and bicarbonate, plus several other constituents, are all higher in the deep drift. Median concentrations of chloride and nitrite plus nitrate, however, are higher in the shallow drift. Agricultural practices, particularly the use of fertilizers, are a possible cause of elevated levels of these constituents in samples collected from shallow-drift wells.

Figures 4 through 17 plot the concentrations of the major ions and dissolved solids in terms of quartiles for shallow- and deep-drift sampling sites. The data plots show that ground water in the glacial-drift aquifers generally is more mineralized in the western part of the State.

Samples from shallow-drift wells indicate that constituents are generally highest in the northwestern and southwestern parts of the State, and that calcium, chloride, and sulfate also are high in the central and east-central parts of the State (figures 4 through 10). Samples from deep-drift wells indicate concentrations of constituents are highest in the western part of the State, particularly in the southwest (figures 11 through 17). Concentrations of calcium and magnesium, however, are more evenly distributed throughout the State than the other constituents.

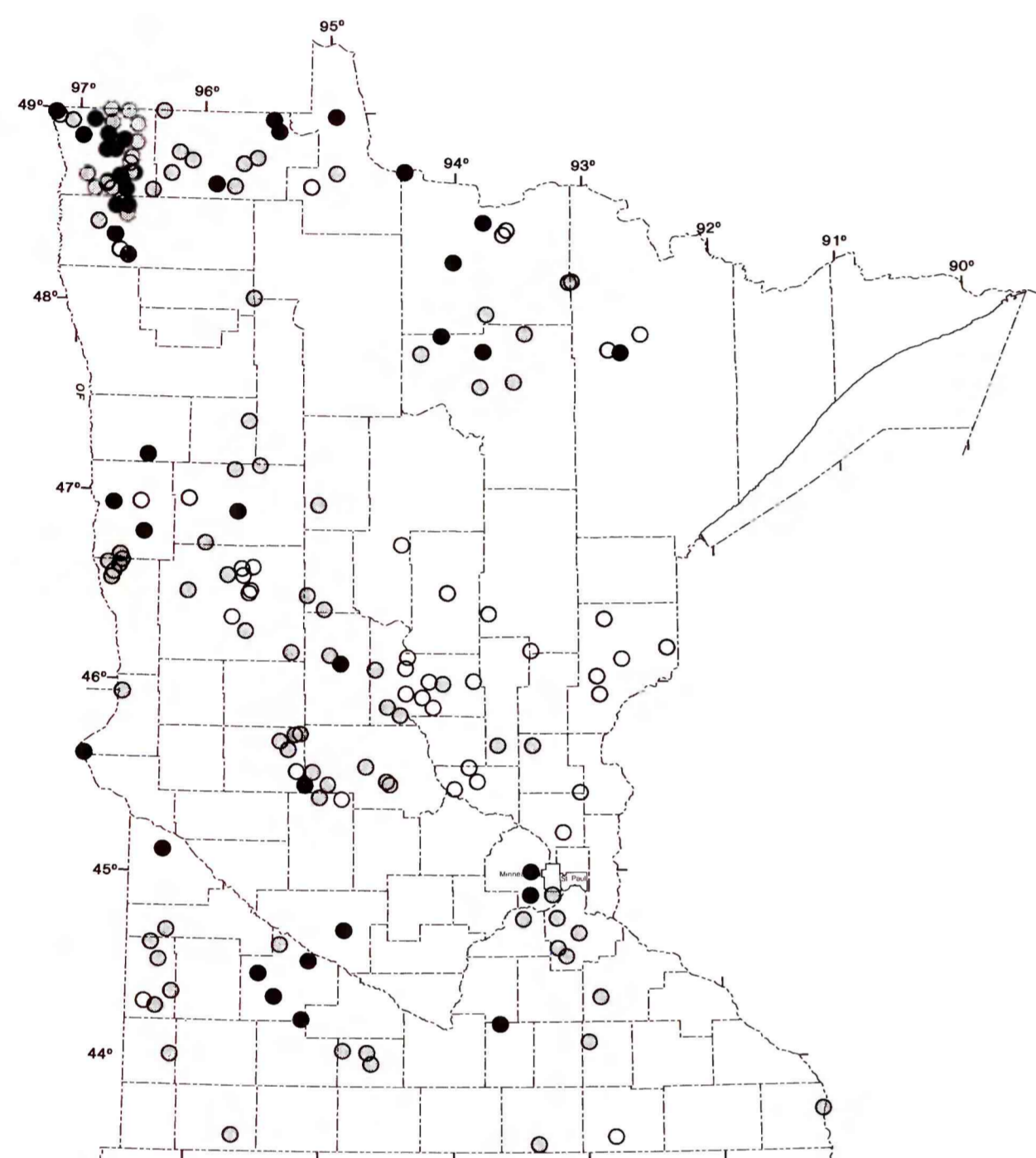


Figure 9.--Bicarbonate

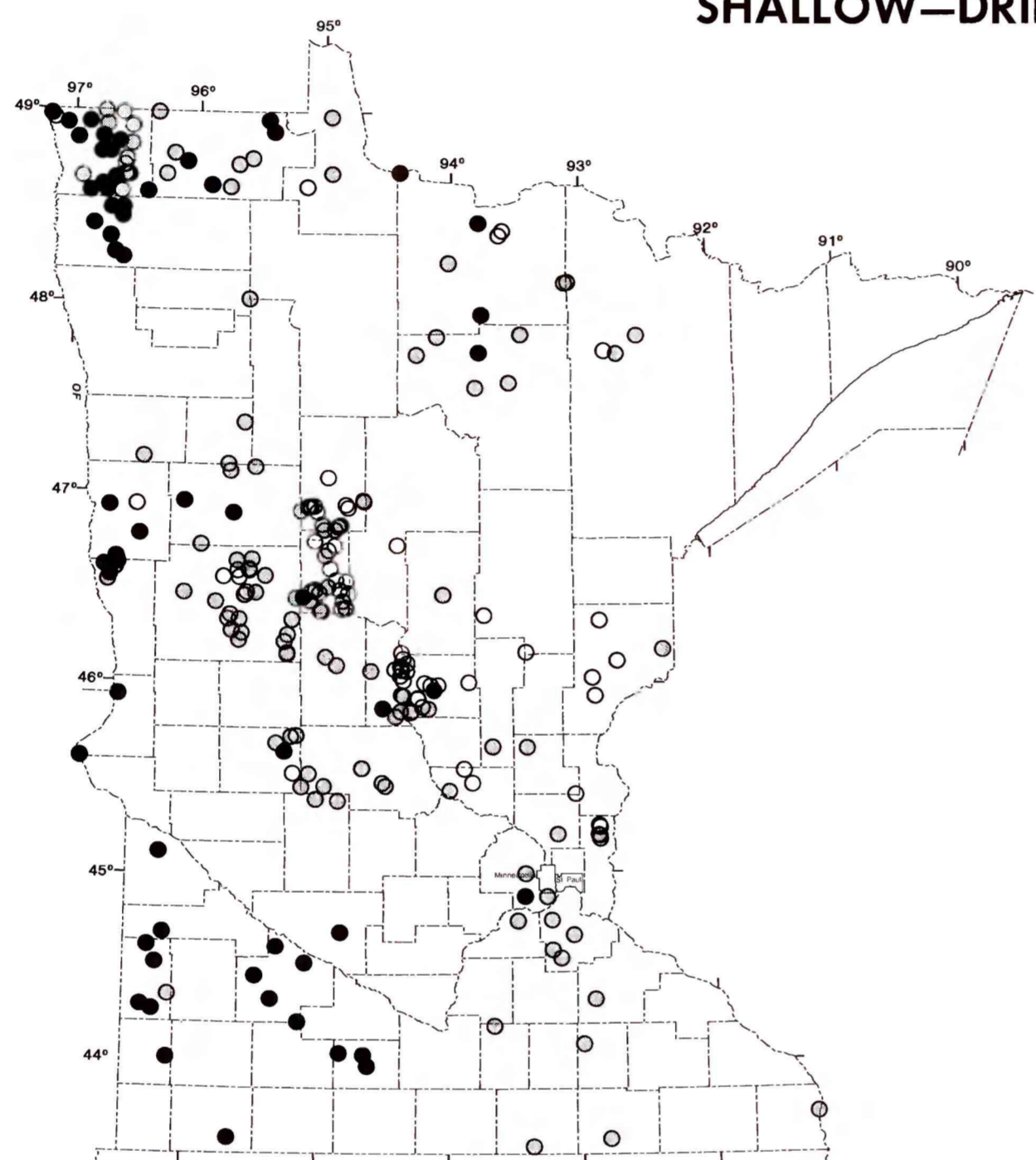


Figure 10.--Dissolved solids

- EXPLANATION**  
WELL LOCATION WHERE THE CONCENTRATION, IN MILLIGRAMS PER LITER, IS IN THE:
- UPPER QUARTILE
  - ONE OF THE MIDDLE QUARTILES
  - LOWER QUARTILE

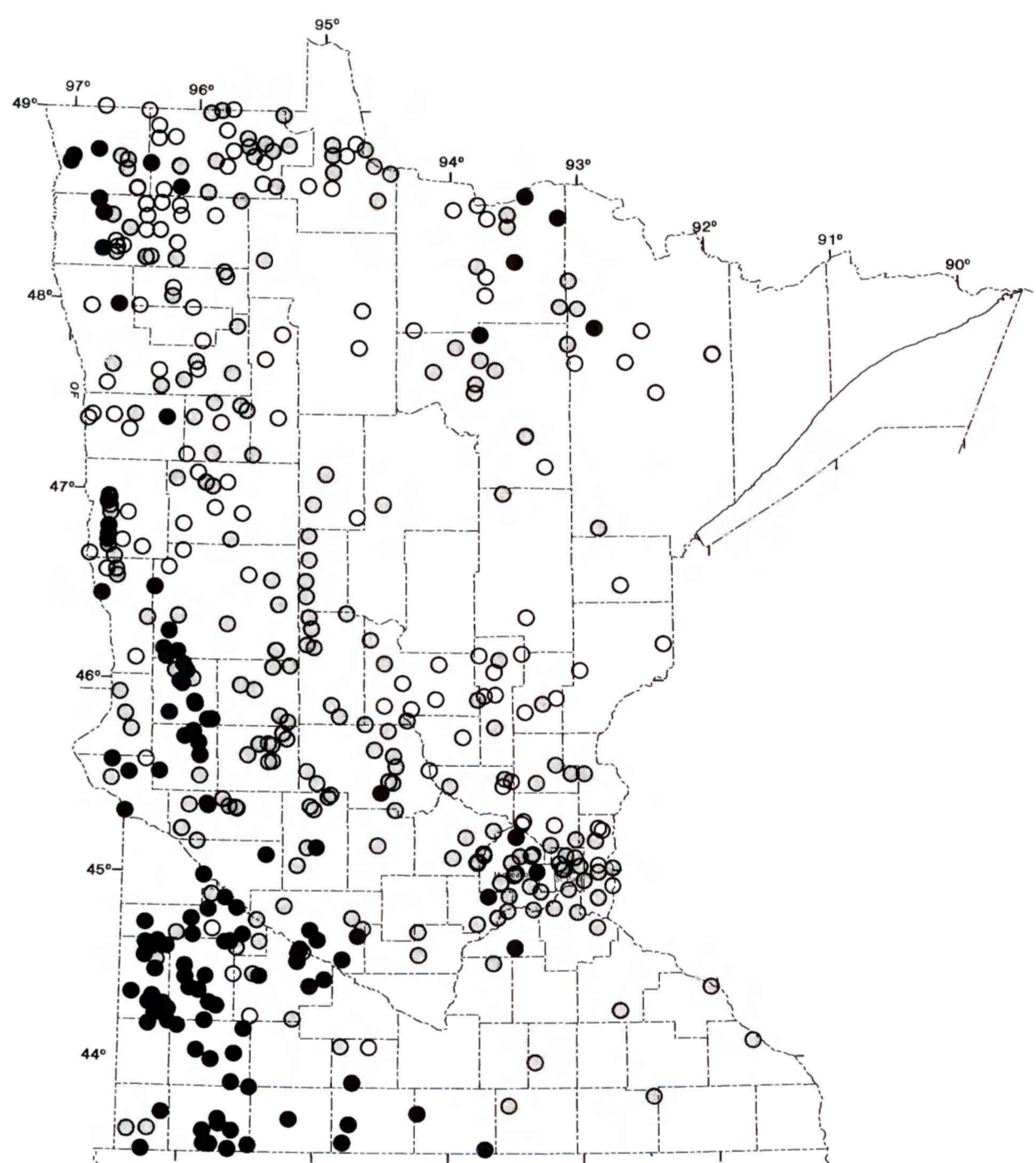


Figure 11.--Calcium

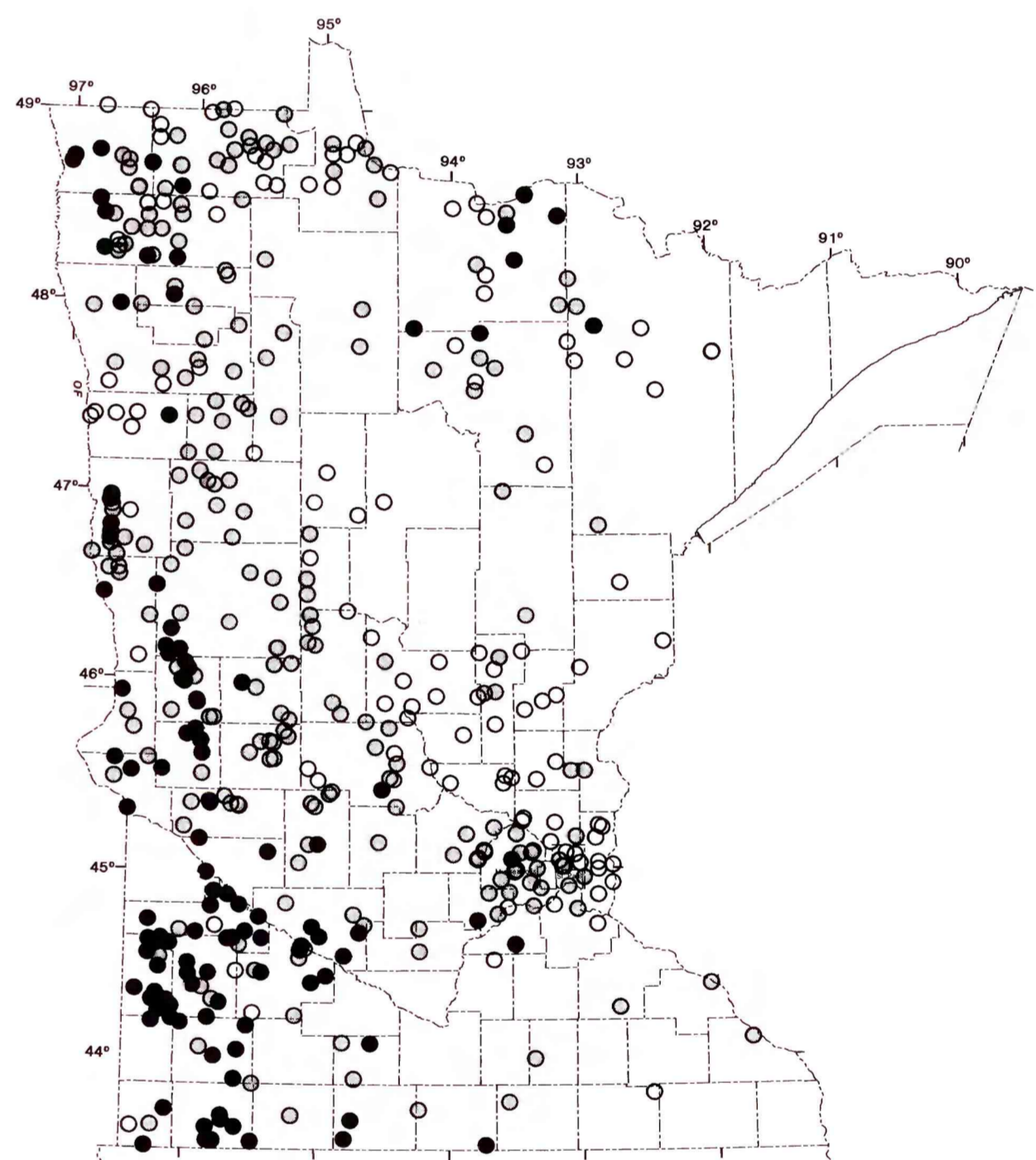


Figure 12.--Magnesium

**DEEP-DRIFT WATER QUALITY**

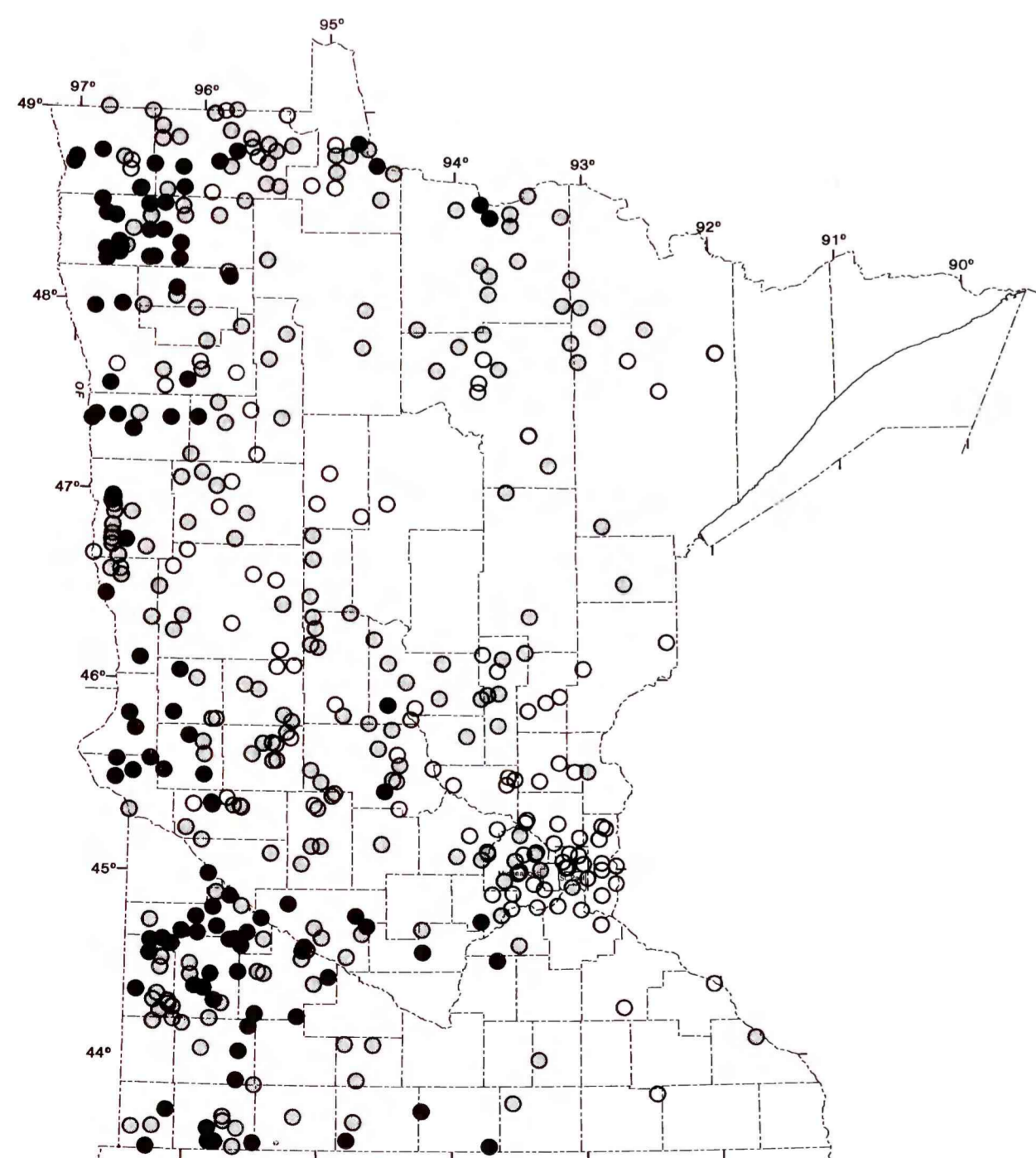


Figure 13.--Sodium

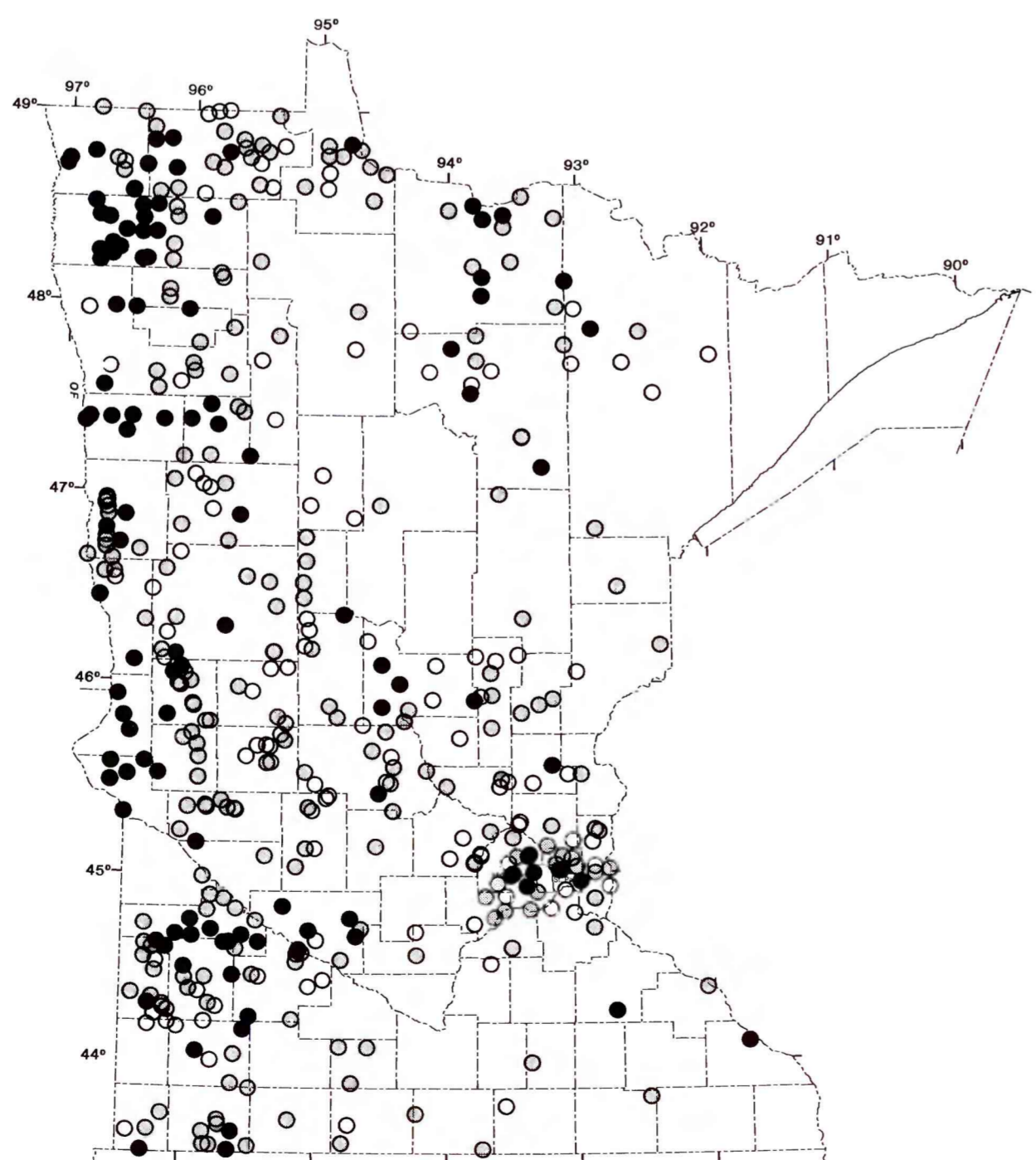


Figure 14.--Chloride

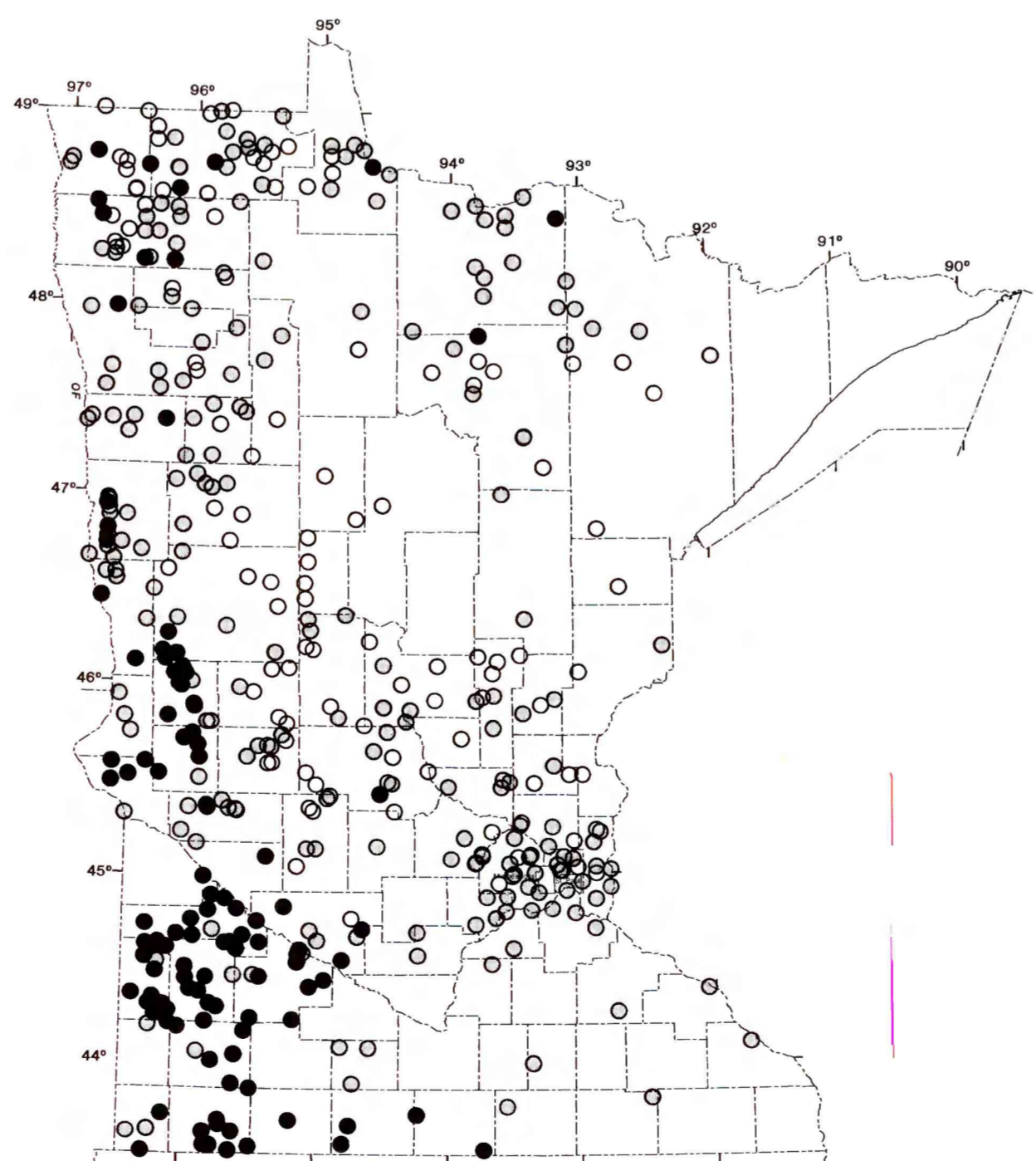


Figure 15.--Sulfate

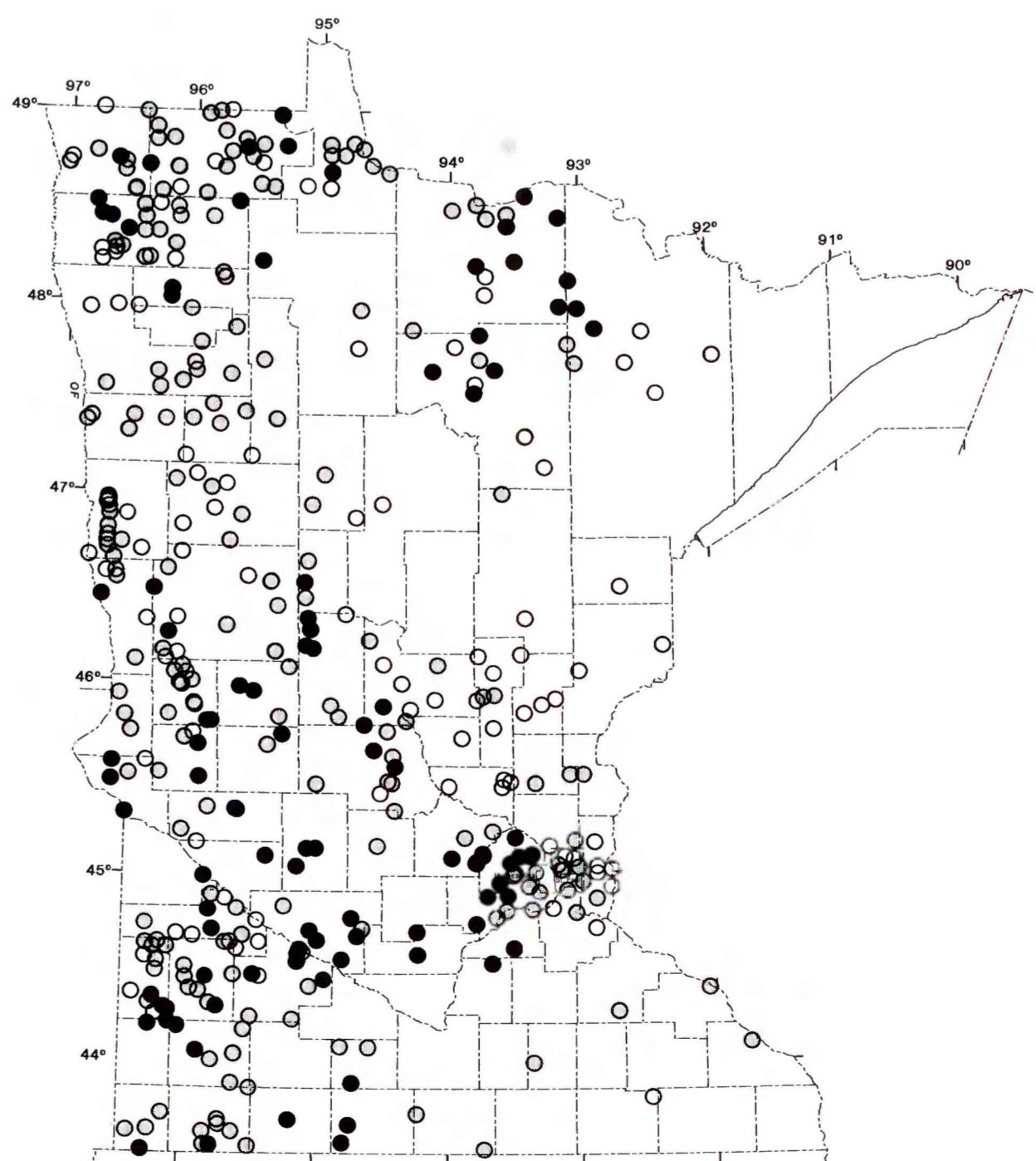


Figure 16.--Bicarbonate

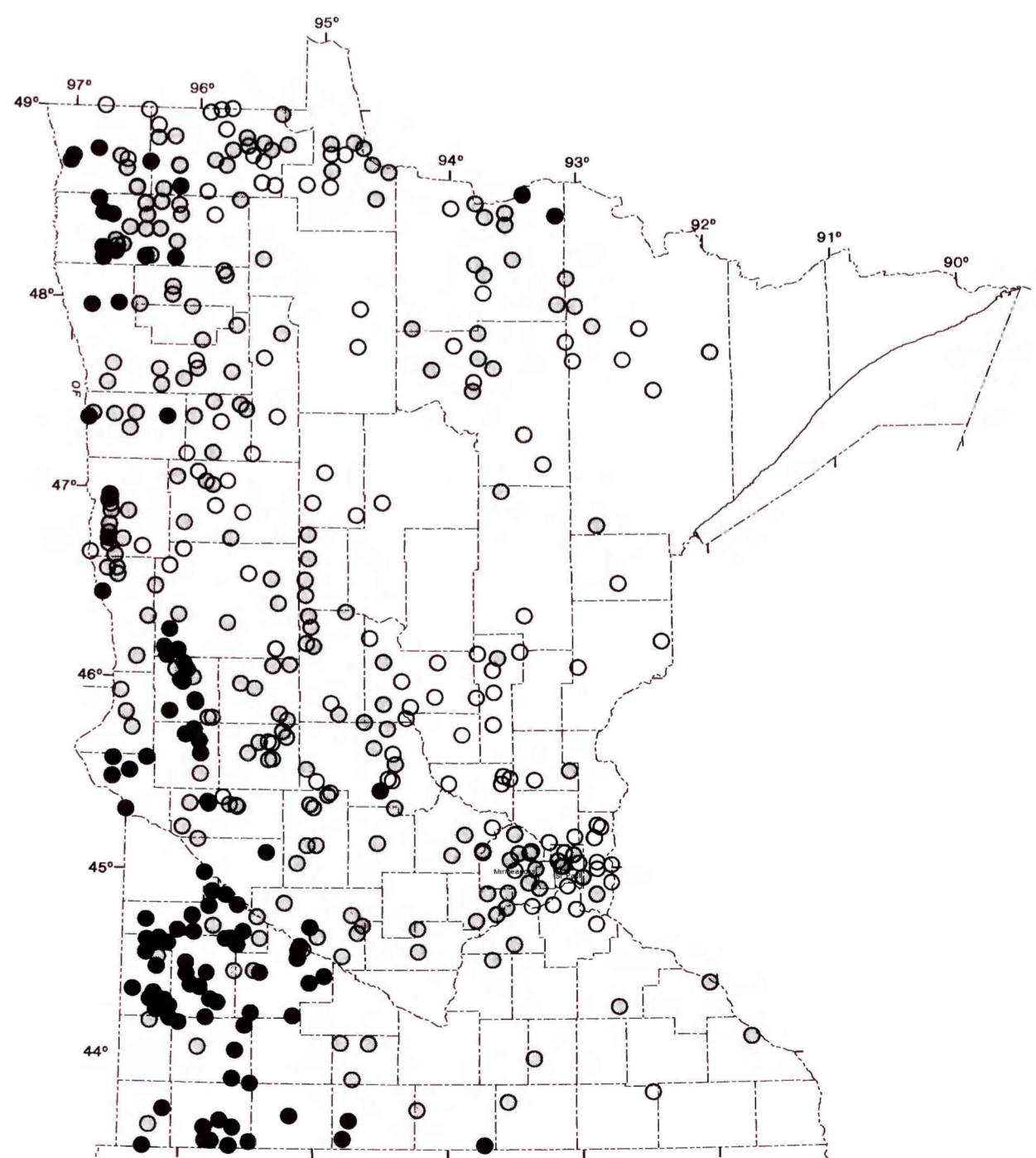


Figure 17.--Dissolved solids

0 20 40 MILES  
0 20 40 60 KILOMETERS

**HYDROGEOLOGIC AND WATER-QUALITY CHARACTERISTICS OF GLACIAL DRIFT AQUIFERS IN MINNESOTA**

BY  
J. F. RUHL, 1987