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GROUNDWATER GEOCHEMISTRY OF THE ST. CROIX CARBONATE AQUIFER SYSTEM

By

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INTRODUCTION

This report is part of an ongoing study of the limestone aquifer system of the central plain of St. Croix. This system supplies St. Croix with a significant and increasing proportion of its water. Although much is known about the system, there still is a major lack of information about the quality and the chemistry of the water drawn from the system.

One major objective of this report is to provide reliable data on St. Croix's groundwater adequate for geochemical modeling and proposed hydrologic analysis. Another objective is to tie in the chemistry of the groundwater to the on-going research on the subsurface geology of the Kingshill Limestone aquifer system.

The central plain of St. Croix is formed by deposits of alluvium and exposures of underlying carbonates (limestone) rocks. The carbonate units contain the majority of the exploited groundwater of the island and range from 0-500 feet in depth. This layer of carbonate is underlain by a dark impermeable Jealousy Formation clay that exceeds 1400 feet in thickness. The impermeable nature of this Jealousy Formation allows it to function as an aquiclude, and it is probably safe to assume that it limits the incursion of salt water from below.

METHODS

A total of 34 samples were taken from 27 wells, rain water, and sea water. (See Figure 1.) The wells sampled were scattered throughout the central plains region of St. Croix. These wells draw their water primarily from the Kingshill Limestone aquifer system of the central plain. Two wells sampled were located on the dry eastern end of the island to contrast water from a completely different aquifer system. The samples came from both public and private wells. The method of collecting and preserving the water samples followed the guidelines established by the U.S. Geological Survey.

RESULTS

Most of the groundwater sampled exceeded the Environmental Protection Agency's limits for chloride and total dissolved solids. Four of the wells analyzed for sulfate exceeded the recommended limits. Although no federal standards exist for sodium, these levels were found to be quite high and pose a potential risk for those on sodium-restricted diets. Trace elements analyzed were all below recommended concentration limits set by the federal government with the exception of iron and manganese. Areas of highly mineralized groundwater are found in the south industrial zone, in the river basin in the Salt River and Concordia areas and in the estates close to the shoreline south of Frederiksted.

The chemistry of the groundwater is best explained by a combination of several processes. The dissolution of aquifer materials by rain water and groundwater is one such process. This dissolution of the aquifer minerals is a process by which groundwater reacts with the minerals of the aquifer, dissolving the rock and altering the composition of both the rock and the groundwater. In the case of carbonate aquifers, much of the breakdown of the rock material can occur because of the rapid dissolution of carbonate minerals. Another process important in explaining the chemical composition of the groundwater of St. Croix is the mixing of sea water with the fresher groundwater. This process naturally increases in importance as the coastline is approached. Close to the coastline there are higher concentrations of chloride, sodium and saline indicating an increase in control of sea water chemistry on the groundwater.

Condensed by Yahaya Bello from: "Groundwater Geochemistry of the St. Croix Carbonate Aquifer System" by Ivan P. Gill and Dennis K. Hubbard, Technical Report No. 27, Water Resources Research Center, Caribbean Research Institute, CVI, St. Thomas, August 1986.

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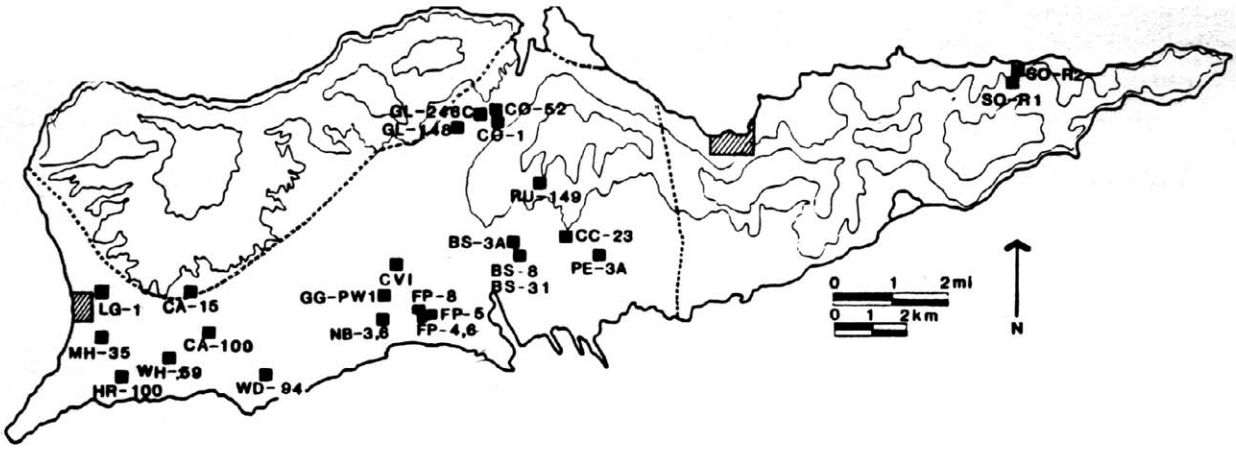

Figure 1. Well sample locations

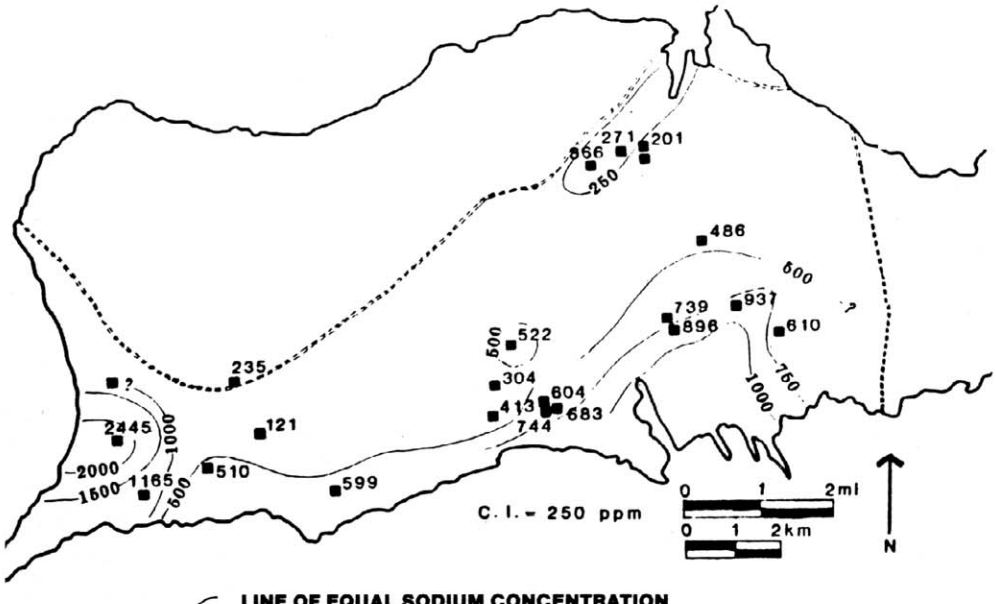

Figure 2. Sodium concentration isopleth map.