RESEARCH PROJECT TECHNICAL COMPLETION REPORT

Institution Institute of Water Resources

Date of Report May 8, 1967

OWRR Project No. A-007-CONN OWRR Agreement No. 14-01-0001

Project Title Correlation of Trace Elements in Ground Water and Aquifers Within the Connecticut River Basin

Principal Investigator H.C.Liese
Project Began May 1965 Project Ended June 1967

Project Objectives

Previous investigations have revealed that one of the most significant factors that influences the chemical quality of ground water in Connecticut is the mineralogy of bedrock units and unconsolidated deposits with which the water is in contact. These correlative studies have been based solely on major element analyses of water and mineral identification (and therefore major element analyses) of the aquifers.

The primary objective of this study was to further and more precisely establish this correlation between ground water and aquifer, on the basis of trace element concentrations. This would first involve the determination of trace element concentrations in minerals from bedrock units and in ground water samples from various parts of Connecticut. After achievement of these objectives, the Connecticut River Basin would then be systematically sampled and analyzed and trace element correlation would be attempted.

The ultimate objectives include a better understanding of ground water problems (e.g. pollution) and activity (e.g. direction of ground water movement), as well as the correlation of "unusual" variations in trace element concentration with communities in which health records are "unusually" good or poor.

Achievement of Project Objectives

Soon after the research began, it was realized that the complete achievement of the objectives would require at least twice the time that was estimated originally.

The partial achievement of the objectives include: (1) the semiquantitative determination of Ag,Ba,Be,Ca,Cu, Ga,Mn,Pb,Sn,Ti and Zr in certain minerals (quartz, potassic feldspar, plagioclase, biotite, and/or magnetite) separated from various bedrock units in Connecticut; (2) the demonstration of "correlation utility" for most of these elements (that is, a systematic relationship was found to exist between trace element concentrations and specific bedrock units); and (3) the estimation and evaluation of precision, sensitivity (detection limits) and accuracy in the analytical technique that was employed, viz. ultraviolet emission spectrography.

Research Procedures Used

Approximately five pounds of rock sample were collected from each of thirty-five localities which are representative of eight bedrock units. The samples were then crushed, pulverized, sieved, and the -20 +65 mesh fraction was chosen for mineral analysis. A Frantz electromagnetic separator was used to concentrate the minerals, and approximately three mg of each were finally selected under the binocular microscope. Purity was checked using infrared absorption analysis.

Spectrographic analysis was accomplished using the relatively new (1964) Applied Research Laboratories "Spectrographic Analyzer". Precision was estimated by calculation of the standard deviation. Accuracy was improved and the detection limits were established by constructing calibration curves using natural and synthetic standards.

Results or Conclusions

The most important findings of this project were that

reasonably precise (and accurate) semiquantitative data can be obtained for Ag,Ba,Be,Ca,Cu,Ga,Mn,Pb,Sn,Ti and Zr ____ in quartz, feldspars, biotite, or magnetite ____ following the particular experimental procedure employed. Moreover, most of the elements (Ag,Ba,Be,Ga,Pb,Sn, and Ti) showed concentration variations that were systematically related to specific rock units.

List of Publications

Liese, H.C.(1967) Mineral chemistry of selected granites and gneisses of New England. Geochim. et Cosmochim. Acta (in press).

Acknowledgement

The work upon which this report is based was supported in part by funds provided by the United States Department of the Interior, Office of Water Resources Research, as authorized under the Water Resources Research Act of 1964.

Abstract

Ultraviolet emission spectrography was employed to obtain reasonably precise semiquntitative data for some trace elements of certain minerals from various bedrock units in Connecticut. The elements determined were Ag,Ba, Be,Ca,Cu,Ga,Mn,Pb,Sn,Ti and Zr. The minerals analyzed were quartz, feldspars, biotite, and magnetite. Most of the elements (Ag,Ba,Be,Ga,Pb,Sn,and Ti) showed concentration variations that were systematically related to specific rock units.

The above data constitute partial achievement of the immediate objectives of this project, which include: (1) the determination of trace element concentrations in minerals from bedrock units and in ground water samples from various parts of Connecticut; and (2) sampling and analyses of minerals from aquifers (bedrock units and

unconsolidated deposits) and ground water from the Connecticut River basin and their correlation based on trace element concentrations.

Keywords

*trace elements
*aquifers
*ground water
*correlation
*ultraviolet emission spectrography