

SOME POSSIBILITIES OF USING THE ISOTOPIC COMPOSITION OF
STABLE ISOTOPES (O,C,H/D) IN THE CHARACTERIZATION OF
THERMOMINERAL WATERS

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Abstract

Knowledge about available quantities and quality of thermomineral waters is becoming more and more important. To answer these questions, we attempted to determine most of the physico-chemical parameters in water reservoirs as well as in the places of their origin. In addition to other investigations we included the measurements of isotopic compositions of hydrogen, oxygen and carbon in H_2O and CO_2 in some thermomineral waters from the western border of the Panonic plain.

A large number of mineral and thermal water sources have been found in this area. They are mostly used for drinking water and for medical purposes. Therefore, knowledge about available quantities of water of known quality is very important. To answer these questions we must find out the origin of the waters and gases, the reason for mineralization and heating and the possibility of regenerating the water, dissolved components and gases which characterize the waters under investigation.

On the border of the Panonic plain it is very difficult to determine whether the mineral and thermal underground waters come from a close basin or if they have their source in the mountains of the western part.

To get good results, adequate sampling is absolutely necessary. Water samples are collected in glass or polyethylene bottles. Gas (CO_2) sampling is more delicate. We have constructed a portable system with an absorption pump (10^{-3} torr). Samples are collected in evacuated glass tubes and closed for transport.

Dried gas (CO_2) is measured directly with double collector mass spectrometer Varian MAT 250. Oxygen in the water is measured after having been allowed to exchange with standard CO_2 gas; the sample is stirred for some hours. To get hydrogen from water, we treated the latter with hot zinc (about 400°C) in a dynamic vacuum system.

Up to now, 200 samples of water from Radenci and surroundings, Rogaška Slatina, Jamnička kiselica and Laško have been analyzed. Some of these results have been reported elsewhere. Most of them can be found in the internal reports.

Diagram No.1 shows the results of the isotopic measurements of CO_2 gas from Radenci in comparison to such results for Rogaška Slatina and Jamnička kiselica.

While the compositions of the latter two are relatively constant, the composition of CO_2 from Radenci varies considerably. For example, in 1970 we analyzed the well 1T. The water there had a temperature of 30°C . The measurement of the isotopic composition of oxygen in CO_2 showed that it originated from a stratum where the temperature was at least 100°C . The result was hardly plausible although the measurements were repeated several times. But it was confirmed when water of a temperature higher than 100°C was obtained from a well in Austria which is less than 1 km from 1T.

The isotopic composition of O and C as well as a low content of hydrocarbons in free gas and water indicates the nonbiogenic origin of CO_2 for the whole district under investigation. This doesn't agree with some authors according to whom the waters and especially the CO_2 from this area are supplied from the Panonic reservoir of oil and water.

The measurements which will make it possible to determine the water supply of these reservoirs are still in progress. We hope that the results of isotopic composition of elements H-C-O will give valuable results with respect to available quantities and the exploitation optimum for these waters. In addition we shall be able to determine the temperature of the $\text{H}_2\text{O}/\text{CO}_2$ equilibrium system.

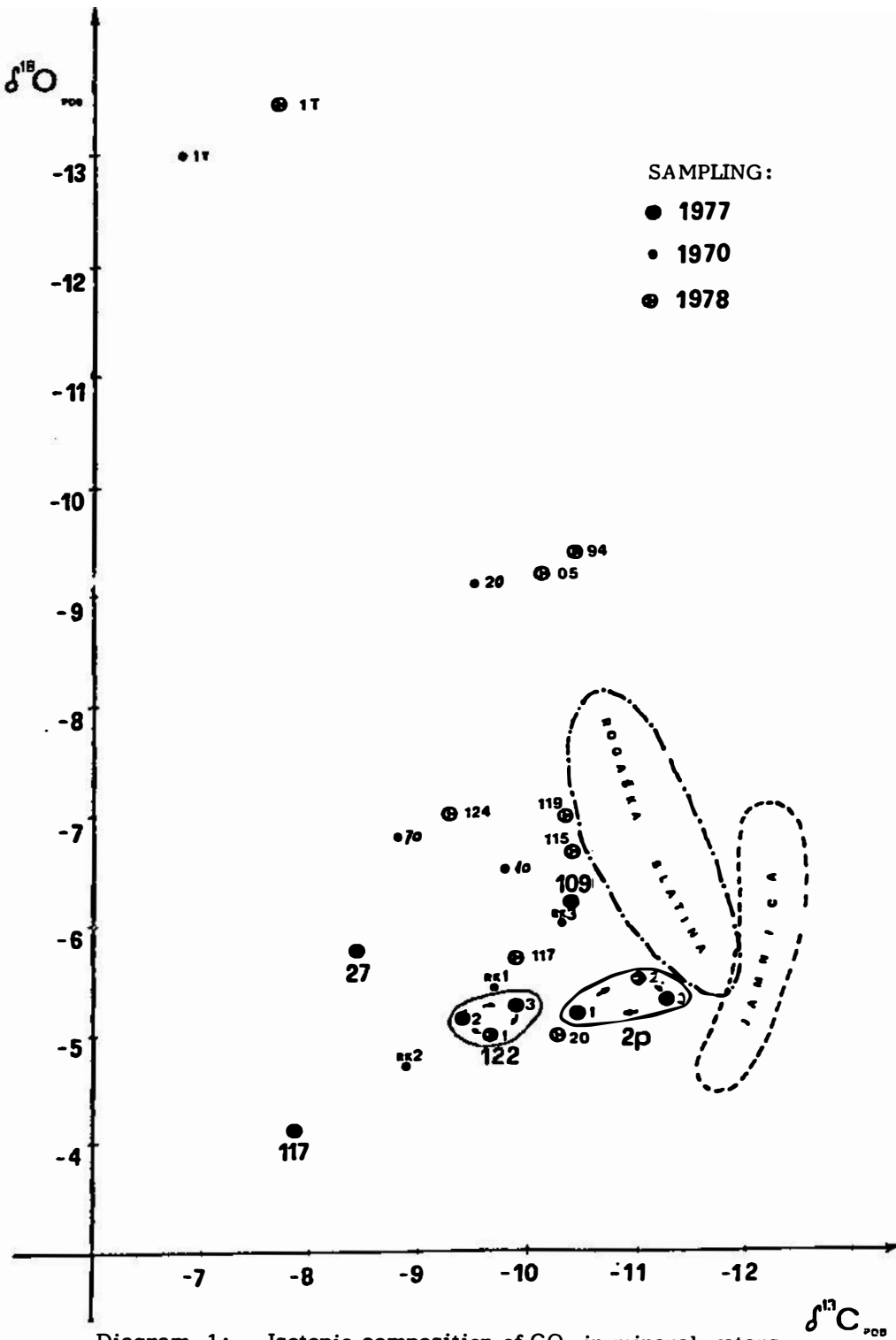


Diagram 1: Isotopic composition of CO_2 in mineral waters.