LOS ALAMOS SCIENTIFIC LABORATORY
UNIVERSITY OF CALIFORNIA
LOS ALAMOS, NEW MEXICO 87544

OFFICE MEMORANDUM

TO : LaMar J. Johnson, H-8 Group Leader DATE: May 22, 1974

FROM : Margaret Anne Rogers, H-8

SUBJECT : ISOTOPIC STUDY OF GROUNDWATER OF THE PAJARITO PLATEAU AND ENVIRONS

SYMBOL : H8-74-199

1048 General

The purpose of the study is to gain a better understanding of the groundwater upon which LASL and Los Alamos County are dependent for water supply. Although water supply has received a great deal of attention since the inception of the Laboratory, there are still questions to be answered concerning the recharge and discharge area for and rate of movement of the groundwater.

Until recently the principal recharge area was believed to be the eastern slopes of the Sierra de los Valles. Purtymun, 1974 in press, now believes the principal recharge area to be the Valles Caldera, and the principal discharge area to be the banks of the Rio Grande. He arrived at these conclusions after long-term observation and envolvement in groundwater studies for the Laboratory. An isotopic study of the groundwater could confirm his conclusions as well as provide better information on the rate of groundwater movement.

The isotopic study of groundwater is a rapidly evolving field. At present a complete isotopic study would envolve ^{14}C, $^{13}C/^{12}C$, ^{3}H, ^{2}H, and $^{18}O/^{16}O$ dating. In an area such as the Pajarito Plateau where no isotopic dating has been done the usual procedure is to do ^{14}C dating first. If the water appears to be very young (that is, if it contains bomb produced ^{14}C), then a tritium analysis is done on a separate sample collected at the same time as the ^{14}C sample. If the water appears to be very old (that is, greater than about 1000 years), then a tritium analysis is not done. If the water appears to be neither very young nor very old, then a tritium analysis is done to try to arrive at a more precise date. In the last case the price of the tritium analysis would approach the price of the ^{14}C analysis--$140.00/sample. $^{13}C/^{12}$analysis is done for better interpretation of ^{14}C data. If $^{13}C/^{12}C$ analysis is done at the same time as ^{14}C analysis, the cost is $20.00/sample. $^{18}O/^{16}O$ analysis is also done for better interpretation of data. $^{18}O/^{16}O$ analysis can be done at the same time as ^{14}C analysis for an additional $20.00/sample. Deuterium analysis seems to be the latest isotopic dating technique. At present, it is not done by any commercial laboratory.

12094

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Each sampling point requires:

1. a maximum of 6 water samples
   a. > 10 gal for ^{14}C analysis
   b. 1 liter for $^{13}C/^{12}C$
   c. 2 oz. for $^{18}O/^{16}O$ or for deuterium
   d. 2 liters for ^{3}H
   e. 6 oz. + 1 liter for chemical analysis

2. a pH measurement taken in the field

3. an alkalinity measurement taken in the field

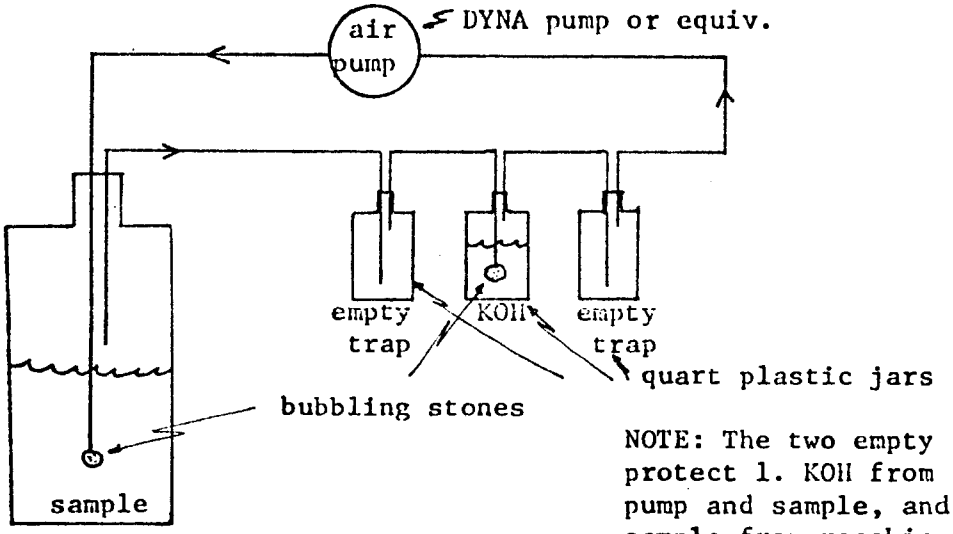
It would be desirable to have isotopic data on every well, test hole, spring or seep in the Los Alamos area. It would, also, be desirable to have data on wells, test holes, and springs in the Valles Caldera. Since an isotopic study has not been done before and since there will be problems in collecting proper size samples from some potential sampling points, it is proposed the initial study envolve 5 samples from test holes and wells on the Pajarito Plateau and 5 samples (taken by the USGS, Albuquerque) from the Valles Caldera. Ten samples will not give us all the information we need to answer our questions, but they should give us enough information to evaluate the types of analyses to be done on other potential sampling points.

MAR:mar
cc: W. D. Purtymun
Merlin Wheeler

GENERAL NOTE: This procedure is designed to remove all the CO_2 dissolved in a water sample and concentrate it as a $BaCO_3$-KOH slurry in a small container easily shipped to the laboratory for analysis. Precautions must be taken as follows:

1. No air should be allowed to leak into the circulating line. This would introduce atmospheric CO_2 to the sample. The amount of air in the jars and connecting tubing should be kept to a minimum.

2. The alkaline solution used to absorb the CO_2 should be free of CO_2 prior to analysis. All reasonable precautions should be taken to prevent contamination of the sample and cross-contamination between samples.



NOTE: The two empty traps are to protect 1. KOH from reaching the pump and sample, and 2. acidified sample from reaching the KOH. As long as they collect little liquid they can be left connected between samples.

PROCEDURE

1. Connect all tubing at the sampler head and three quart jars. Inspect for any loose connections.
2. Add KOH solution to middle plastic quart jar. Seal immediately with black electrical tape
3. Add about 300 ml concentrated HCl to sample. Seal bubbler head on immediately and start pump.
4. Look for leaks. Make sure both sample and KOH bubbling stones are working. Run for 3-4 hours depending on sample size, checking bubbling action periodically.
5. Clean up equipment before next run with tap or distilled water.

PREPARING CO_2 FREE KOH

1. Make up several liters of about 2N KOH or NaOH (about 80gNaOH/1, about 68gKOH/1). Fill 5-10 liter plastic jug.
2. Add about 60g/1 $BaCl_2$. Shake and let settle overnite.
3. Carefully, without mixing up the $BaCO_3$ precipitate on the bottom of the jug, half fill (about 500 ml) the KOH bubblers to be used in future and keep sealed until ready to start a sample.

MATERIALS NEEDED

1. KOH or NaOH, concentrated HCl, distilled water.
2. 10-30 gallon Nalgene sample containers, 3 quart Nalgene containers, 2-holed rubber stoppers to fit each.
3. 2 coarse glass bubbling frits.
4. 1/4 " i.d. tygon tubing and about 3' 1/4" o.d. glass tubing.
5. Small Dyna pump or equivalent.
6. Box to hold quart jars and pump.

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Service Specifications and Prices

Tritium Measurement Services

Effective: 1 August 1973*

All tritium analysis are performed with state-of-the-art liquid scintillation counters, capable of both high-level and ultra-low-level analysis. The present capacity of the laboratory is over 10 low-level samples per week. Enrichments are carried out in thermally regulated base electrolytic enrichment cells.

METHOD	AMOUNT OF SAMPLE REQUIRED	DETECTION LIMITS	OVERALL UNCERTAINTY	COST $
Direct (H_2O)	1-5 ml	200TU	± 100 TU (2%)	$40
Electrolytic Enrichment (H_2O)	200-1000 ml	20 TU	± 10 TU (2%)	$80
Benzene Synthesis	25-100 ml	10 TU	± 5 TU (2%)	$120
Electrolytic Enrichment & Benzene Synthesis	500-2500 ml	1 TU	± 0.5 TU (2%)	$160

Delivery of results is normally well within 60 days of receipt of samples for tritium analysis. Subject to backlog, samples are processed on a first come first served basis.

For further details regarding this service, write Mr. Richard R. Pardi, Radiocarbon Manager, describing your problems or applications. Or call 617-876-3691.

*Prices and delivery schedules subject to change without notice.