REGIONAL HYDROGEOCHEMISTRY

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RECORD

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Scientific Notebook #094
Supporting the Regional
Hydrology Research Project

CONTROLLED
#094

This notebook is intended to be used to document activities related to the Regional Hydrology Research Project

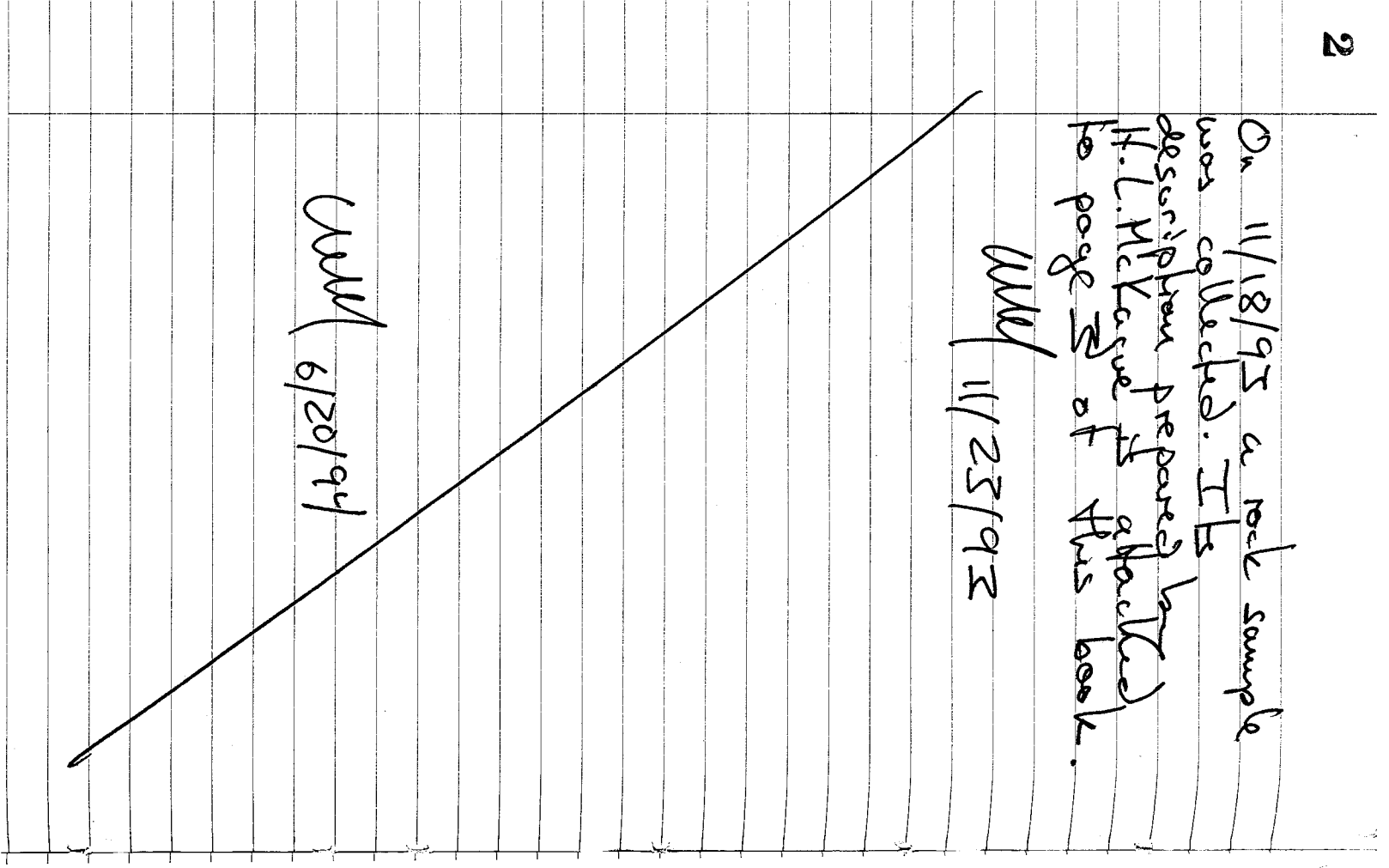
William M. Murphy is identified by

William M. Murphy

11/14/93

On 11/18/93 a rock sample was collected. The description prepared by H.L. McKague is attached to page 2 of this book.

11/23/93

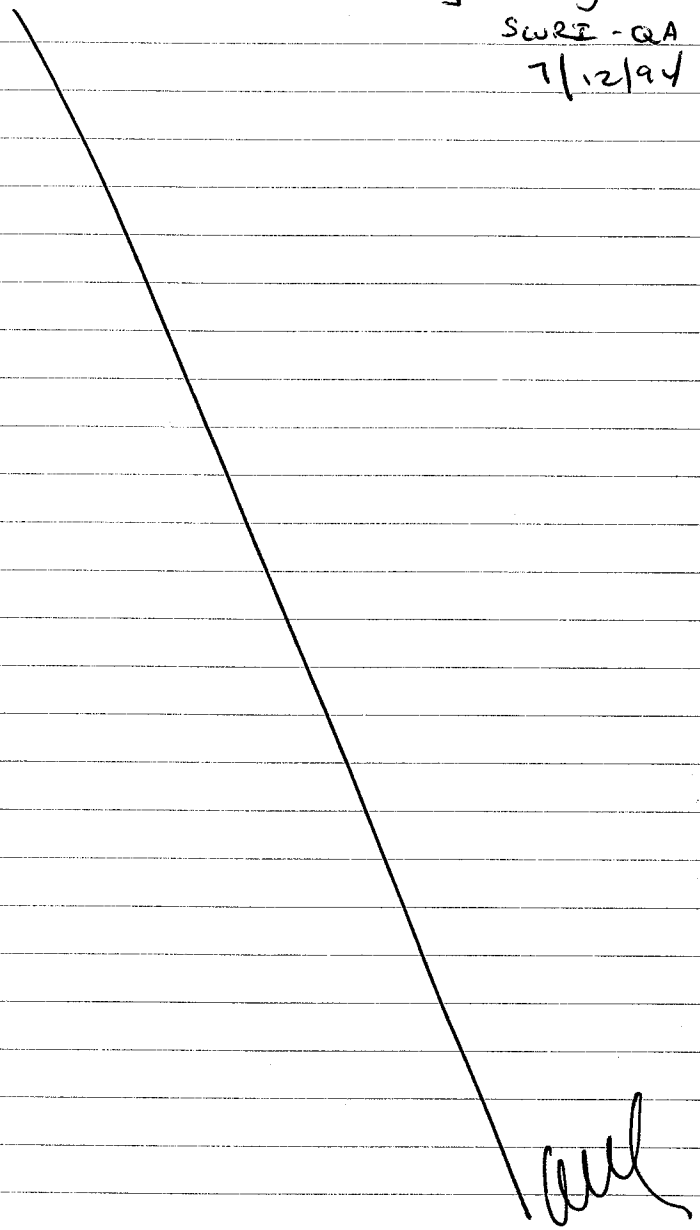


Rock sample HT(Hydrology Test) 11-18-93-001 was collected by Budhi Sagar on Nov. 18, 1993; at DOE well WT-7 at the south end of Boomerang Ridge, Nye County, Nevada. The sample was taken from the outcrop at the west edge of the drill pad. The rock is a devitrified densely welded ash-flow tuff from the Tiva Canyon Formation. Secondary vein filling mineralization occurs on two exterior surfaces and as a 1/8 th inch thick vein. The secondary mineralization in the vein and on the smaller exterior surface seem to consist of relatively pure carbonate. The secondary mineralization on the larger exterior surface appears to contain secondary silica mineralization, brecciated Tiva Canyon Tuff in addition to the carbonate mineralization.

11/23/93

Pages 1-4 of this notebook were reviewed for compliance with QAP-001 in response to CAR 94-02.

Verified by: Randy Folck
SwRI - QA
7/12/94



2/24/95

Analysis of water distribution in UZ-16

Porosity : 30% *

Saturation : 95% *

* from Wittmeyer/Flint for the zeolitized Calico Hills

UZ-16 is near USW H-4

H-4 is at 4096.5' elevation and UZ-16 is at 4001' elevation per GIS database

Calico Hills formation is from 1205.5' to 1465.9' depth in UZ-16 per Wittmeyer/Flint

Corresponding depths in USW H-4 are from 1301' to 1560.5'.

2/24/95

Zeolites from 1312' depth in H-4 are given by Broxton et al 1986

A typical one is

~~$K_{6.16}$~~ MM 2/24/95

$K_{6.33}$ $Na_{6.22}$ $Ca_{0.43}$

$Al_{13.91}$ $Fe_{0.61}$ $Si_{72.5}$ $Ti_{0.03}$

$O_{173.595} \cdot n H_2O$

Based on 24 structural oxygens

$K_{0.88}$ $Na_{0.86}$ $Ca_{0.06}$ $Al_{1.92}$ $Fe_{0.08}$ $Si_{10.03}$ 24

$\cdot n H_2O$

MM 2/25/95

Fisher et al (1989) gives mineralogy of H-4. A clinoptilolite zone extends from 1310' depth to 1550' depth. These rocks are 50 to 90% clinoptilolite.

An End member rocks from this zone given in A

% weight fraction	A	B
Clinopt.	78±10	70±14 + 9±2 mordenite
Quartz	3±2	~~17±5~~ Tr MM 2/24/95
Cristobalite	9±4	-
Alkali fs	10±5	3±1
Opal-CT		17±3
	101	

However there is not Opal-CT given in this older analysis. Rocks from the same stratum from USGS at Typically have 20% opal. A silica rich-zeolite rich variety is given in B.

MM 2/24/95

A lower clinoptilolite tuff from the Calico Hills of H-4 is

smectite	3±2	% weight
clinopt	29±10	
mordenite	16±5	
quartz	11±3	
cristobalite	10±4	
alk. fs.	31±10	

Given 1 dm^3 (=1 liter) of rock $.95 \times 300\ cm^3 = 285\ cm^3$ of water in porosity

Assuming weight % ≈ volume % of mineralogy

78% wt % clinopt × $700\ cm^3$

$= 546\ cm^3$ clinoptilolite

Using a density of 2.16 for Na,K clinoptilolite (from Deer Howie + Z.)

$546\ cm^3 \times 2.16 \frac{g}{cm^3} = 1179\ g$

9/24/95

Assuming a stoichiometric 8 H_2O per 24 structural oxygens the molar mass of our H-4 ~~zolite~~ is ~~906.8~~ g/mole.

9/24/95

906 g/mole.

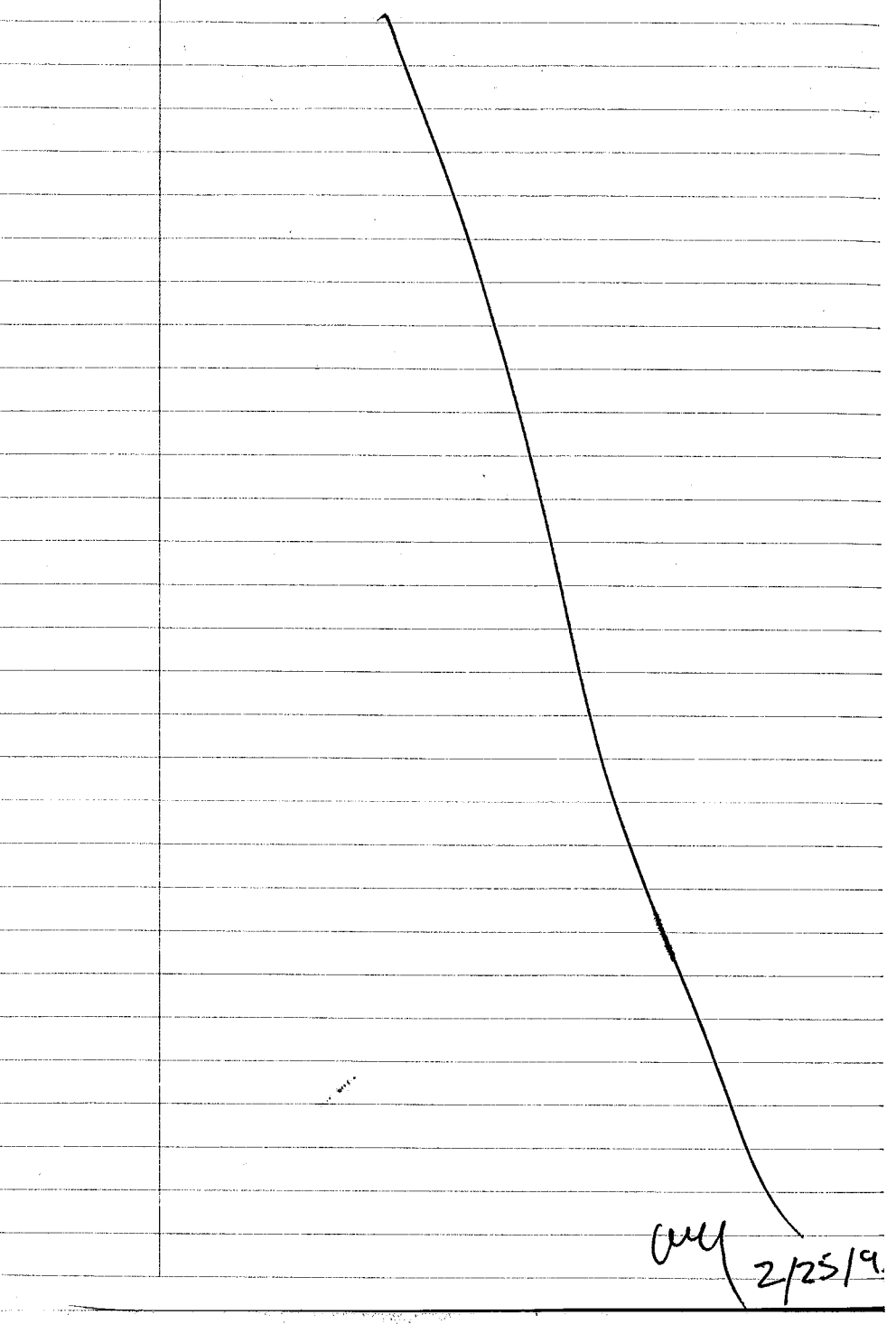
So our 1179 g of clinoptilolite ≈ 1.3 moles

1.3 mole clinopt.
× 8 moles H_2O / mole clinopt.
× 18 g H_2O / mole H_2O
= 187.2 g H_2O

2/25/95

10

One page attached



Uu 2/25/9

Excerpt from
Broxton et al. 1986

APPENDIX E (cont)

Drill Hole USW H-4

Depth (ft) Unit[a]	1312 Tht	1312 Tht	1312 Tht	1312 Tht	1312 Tht	1312 Tht
SiO2	73.9	74.3	73.4	74.0	74.0	74.0
TiO2	0.04	0.04	0.02	0.05	0.05	0.01
Al203	12.0	12.1	12.0	12.3	12.0	12.0
Fe203	0.67	0.83	0.86	0.77	0.83	0.73
MgO	0.00	0.00	0.00	0.00	0.00	0.00
CaO	0.43	0.41	0.43	0.45	0.49	0.43
BaO	0.00	0.00	0.00	0.00	0.00	0.00
Na2O	3.27	3.29	3.03	3.38	3.28	3.16
K2O	4.91	5.09	5.39	4.96	5.37	5.25
Total	95.2	96.1	95.1	95.9	96.0	95.6
			Cation Percent			
Si	72.7	72.5	72.4	72.2	72.2	72.6
Ti	0.03	0.03	0.01	0.04	0.04	0.01
Al	13.92	13.91	13.95	14.15	13.80	13.87
Fe	0.50	0.61	0.64	0.57	0.61	0.54
Mg	0.00	0.00	0.00	0.00	0.00	0.00
Ca	0.45	0.43	0.45	0.47	0.51	0.45
Ba	0.00	0.00	0.00	0.00	0.00	0.00
Na	6.24	6.22	5.79	6.39	6.20	6.01
K	6.16	6.33	6.78	6.17	6.68	6.57
			Si/(Al+Fe)			
	5.04	4.99	4.96	4.91	5.01	5.03
			(Al+Fe)/(2Mg+2Ca+2Ba+Na+K)			
	1.08	1.08	1.08	1.09	1.04	1.07
			Mol% Exchangeable Cations			
K	47.9	48.8	52.0	47.4	49.9	50.4
Na	48.5	47.9	44.5	49.0	46.3	46.1
Ca+Mg	3.5	3.3	3.5	3.6	3.8	3.5
			Oxides Recalculated to 100%			
SiO2	77.61	77.35	77.16	77.16	77.07	77.42
TiO2	0.04	0.04	0.02	0.05	0.05	0.01
Al203	12.60	12.60	12.61	12.82	12.50	12.55
Fe203	0.70	0.86	0.90	0.80	0.86	0.76
MgO	0.00	0.00	0.00	0.00	0.00	0.00
CaO	0.45	0.43	0.45	0.47	0.51	0.45
BaO	0.00	0.00	0.00	0.00	0.00	0.00
Na2O	3.43	3.42	3.19	3.52	3.42	3.31
K2O	5.16	5.30	5.67	5.17	5.59	5.49

This research project was formally closed on January 19, 1996. This notebook contains a brief outline of geochemical speciation studies conducted for groundwater collected and analyses conducted by others. Most of the work described herein is summarized in detail in the semi-annual research reports.

Gordon Wittmeyer

Principal Investigator

2/5/96