

ZEO WHAT ??????

By

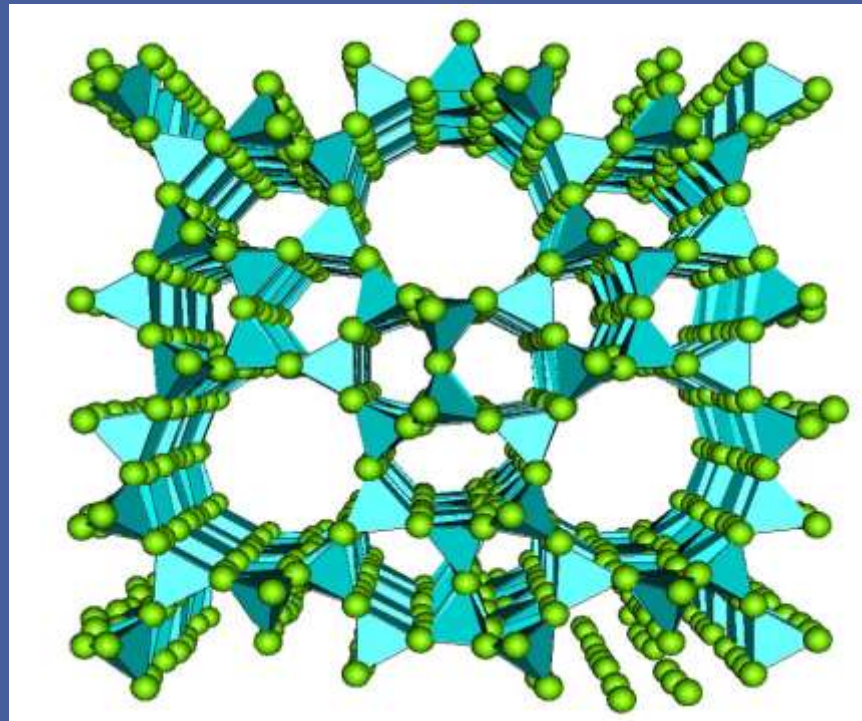
T. Hilton J. Campbell D. Eyde J. McEnaney



WHAT IS ZEOLITE ?????

From St. Cloud Mining:

“Generally speaking, natural zeolites are hydrated aluminosilicates. They consist of an open, three-dimensional cage-like structure and a vast network of open channels extending throughout. Loosely bound, positively charged atoms called cations, are attached at the junctures of the negatively charged aluminosilicate lattice structure. The aluminosilicate framework provides exceptional strength and stability to the lattice structure.



WHAT IS ZEOLITE ??????

From WOPEC

Zeolite is a MBBAR (short for “Mind Blowing Bad Ass Rock”) that removes iron, aluminum, and manganese without producing any sludge, while simultaneously raising low pH mine drainage by removing hydrogen ions and lowering high pH's of over-treated water generally associated with manganese removal. Also, it will remove certain cations responsible for creating high Dissolved Solids and/or high Osmotic Pressure.

Change Something Like This



To Something Like This



Industrial Uses of Zeolite

Animal feed supplements and animal hygiene and odor control

Horticulture and soil amendments

Aquaculture, aquaria, hatchery and pond filtration

Drinking water, surface water, ground water and waste water treatment

Air filtration and pollution control media

Oil absorbing floor drying materials, industrial fillers

The removal of some organic compounds from oil field waters

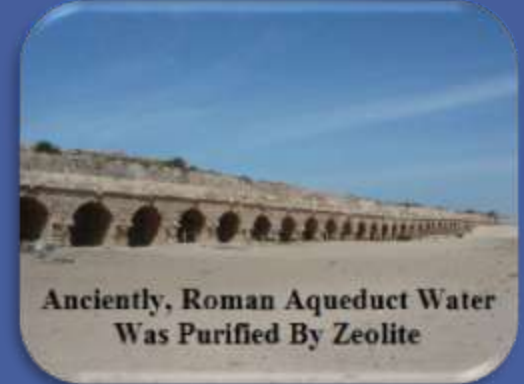
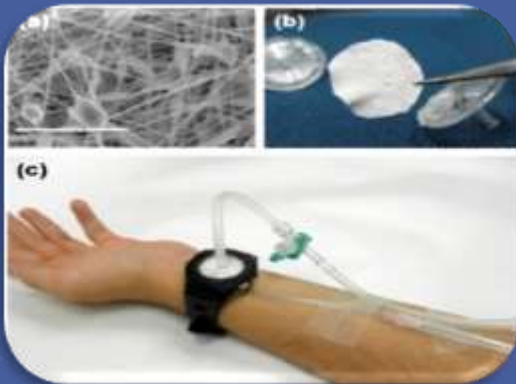
Municipal, industrial and private facility water treatment

Concrete additive with pozzolanic properties that increases strength

Odor elimination

Flow and anti-caking agent in industrial and agricultural material handling

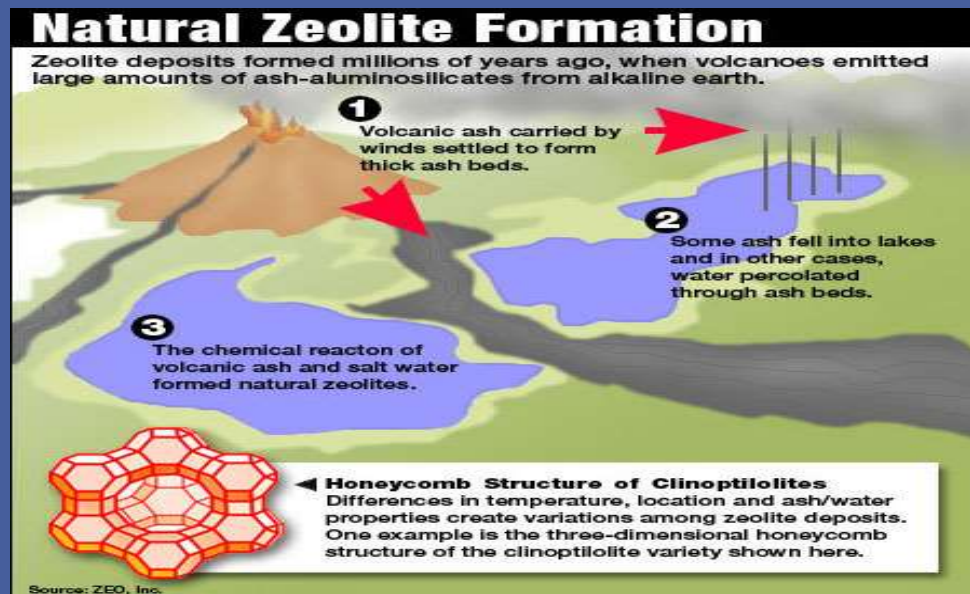
Industrial Uses of Zeolite



How Did Zeolite Form ?

(From St. Cloud Mining)

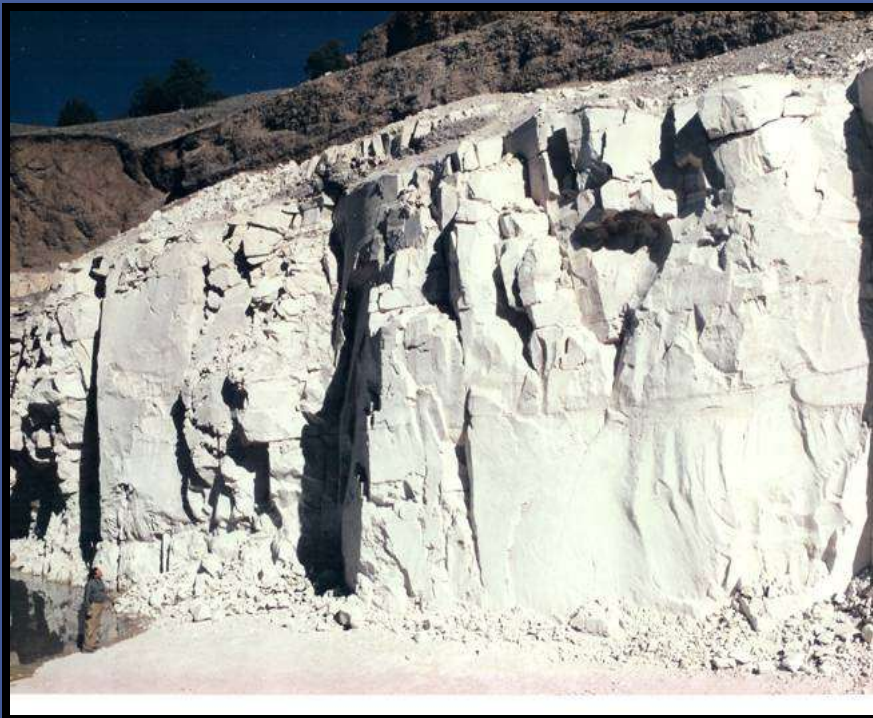
- Zeolite is a crystalline mineral that was formed from the eruption of volcanoes over a period of 50-350 million years ago. As the volcanoes erupted, they ejected enormous amounts of ash. After the ash had drifted sufficiently far enough away from the eruption so all particulates except for silicates had dropped out, some of the remaining ash fell into water. This is where the Zeolite formation process began. In order for the Zeolite formation process to go to completion,
- --the receiving water had to have the right amount and types of alkaline salts,
- --the area where formation was taking place had to be stable for at least half a million years, and
- --the deposit had to be compressed for a few million years to transform into a hard rock mineral.



U.S. Zeolite Locations

In the US-Commercial Zeolite Deposits Occur in:

Arizona-----New Mexico
Nevada-----California
Oregon-----Texas
Wyoming



Zeolite & Mine Drainage

- Zeolite** will raise low pH by extracting the Hydrogen Ions associated with such.
- Zeolite** reduces pH from over-treatment for Manganese. (Don't yet know why.)
- Zeolite** removes Dissolved Iron.
- Zeolite** removes Dissolved Aluminum.
- Zeolite** removes Dissolved Manganese.
- Zeolite** removes resolubilized aluminum due to high pH.
- Zeolite** reduces Dissolved Solids by removing Na or Ca from conventionally treated mine drainage.
- Zeolite** can be renewed once the CEC, Cation Exchange Capacity has been reached through the use of a saline solution.
- A Saline Solution Renewal process may be preferable, prior to using for treatment to enhance extraction ratios by expelling other cations inherent to the **Zeolite** structure itself.
- Zeolite** does not produce a solid sludge, but rather releases all the treatment related extracted metals in a dissolved form during the renewal process. This solution may then be collected and hauled to a disposal site such as the local sewage plant or to a lined evaporation cell near the site.
- Zeolite** probably has many other potential treatment capabilities which have yet to be revealed.

Test Results



Test 1-Does Zeolite Do Anything?



RAW WATER ANALYSIS

Parameter	Sample 1	Sample 2	Sample 3
pH	3.31	2.97	2.52
Dissolved Fe	2.48	9.23	617.20
Dissolved Mn	32.23	53.13	29.34
Dissolved Al	48.82	52.24	109.80

Test 1 Results

Sample 1

Parameter	Raw Water	After Zeolite
pH	3.31	5.71
Dissolved Fe	2.48	0.21
Dissolved Mn	32.23	8.27
Dissolved Al	48.82	0.11

Sample 2

Parameter	Raw Water	After Zeolite
pH	2.97	5.32
Dissolved Fe	9.23	0.22
Dissolved Mn	53.13	14.83
Dissolved Al	52.24	0.46

Sample 3

Parameter	Raw Water	After Zeolite
pH	2.52	4.00
Dissolved Fe	617.20	46.60
Dissolved Mn	29.34	30.01
Dissolved Al	109.80	12.05

Test 2-Al Extraction-Part 1

Raw Water Analysis

Parameter	Results
pH	7.03
Alkalinity	116.36
Acidity	<0.33
Dissolved Fe	0.10
Dissolved Mn	0.26
Dissolved Al	0.16

Test Results

Parameter	Raw Water	Zeolite-Test 1	Zeolite-Test 2
Dissolved Fe	0.10	<0.01	<0.01
Dissolved Mn	0.26	0.02	0.17
Dissolved Al	0.16	0.03	0.04

Test 2-Al Extraction-Part 2

MBBAR “FOR SURE”

Parameter	Raw AMD	AMD- NaOH	AMD- NaOH Zeolite	AMD- Ca(OH) ₂	AMD-Ca(OH) ₂ Zeolite
pH	3.45	10.89	8.29	11.71	9.64
Alkalinity	<0.45	162.64	25.23	604.67	31.51
Acidity	739.89	<0.33	<0.33	<0.33	<0.33
Conductivity	4,410.00	4,310.00	2,548.00	4,820.00	2,677.00
Dissolved Fe	213.00	0.01	0.04	0.02	0.01
Dissolved Mn	30.50	<0.001	0.02	0.001	<0.001
Dissolved Al	52.68	1.46	<0.008	0.127	<0.008
Dissolved Na	25.78	871.30	336.20	54.44	156.80
Dissolved Mg	149.30	0.34	35.37	0.24	16.01
Dissolved Ca	194.86	84.61	221.60	936.30	518.40
TDS	3,111.00	2,914.00	2,025.00	3,320.00	2,120.00

OS. PR.	91.47	85.70	59.55	97.64	62.35
----------------	--------------	--------------	--------------	--------------	--------------

TEST 3-CONTACT TIME ???

Raw Water Analysis



Parameter	Analysis
pH	6.74
Alkalinity	71.91
Dissolved Fe	<0.01
Dissolved Mn	2.65



Parameter	Raw	1 Min.	2 Min.	3 Min.	4 Min.	5 Min.	6 Min.	7 Min.	8 Min.	9 Min.	10 Min.
Diss. Mn	2.65	1.948	1.99	2.02	2.01	1.97	2.11	1.97	1.96	2.01	1.97
Diss. Na	2.99	15.98	17.06	17.08	18.17	18.66	16.54	48.99	18.95	18.15	34.65
Diss. Mg	30.10	23.02	24.11	24.89	24.62	24.58	25.79	25.17	24.71	25.21	25.19
Diss. Ca	51.25	51.90	55.49	57.67	58.11	59.85	60.08	62.01	60.48	61.13	61.42

TEST 4-ZEOLITE CAPACITY ???

Sample	Time Min.	Raw Mn	Zeo-Mn	Net Mn	Raw Na	Zeo-Na	Raw Mg	Zeo-Mg	Raw Ca	Zeo-Ca
1	30	2.65	0.73	-1.92	2.99	24.55	30.10	18.91	51.25	67.09
2	30	2.65	0.97	-1.68	2.99	19.54	30.10	20.18	51.25	63.95
3	60	2.65	0.72	-1.93	2.99	23.55	30.10	19.00	51.25	66.99
4	30	2.65	1.07	-1.58	2.99	17.06	30.10	20.81	51.25	62.67
5	60	2.65	0.97	-1.68	2.99	19.12	30.10	20.55	51.25	63.56
6	45	2.65	1.08	-1.57	2.99	17.42	30.10	21.23	51.25	62.46
7	60	2.65	0.99	-1.66	2.99	18.56	30.10	20.10	51.25	61.70
8	90	2.65	0.99	-1.66	2.99	18.97	30.10	20.49	51.25	62.28
9	18*	2.65	0.58	-2.07	2.99	32.05	30.10	20.65	51.25	76.59
10	60	2.65	0.88	-1.77	2.99	21.34	30.10	20.57	51.25	64.48
11	60	2.65	1.03	-1.62	2.99	18.74	30.10	21.29	51.25	63.61
12	60	2.65	1.12	-1.53	2.99	17.39	30.10	21.88	51.25	63.33

18*--Hours not Minutes

TEST 4-ZEOLITE CAPACITY Cont.

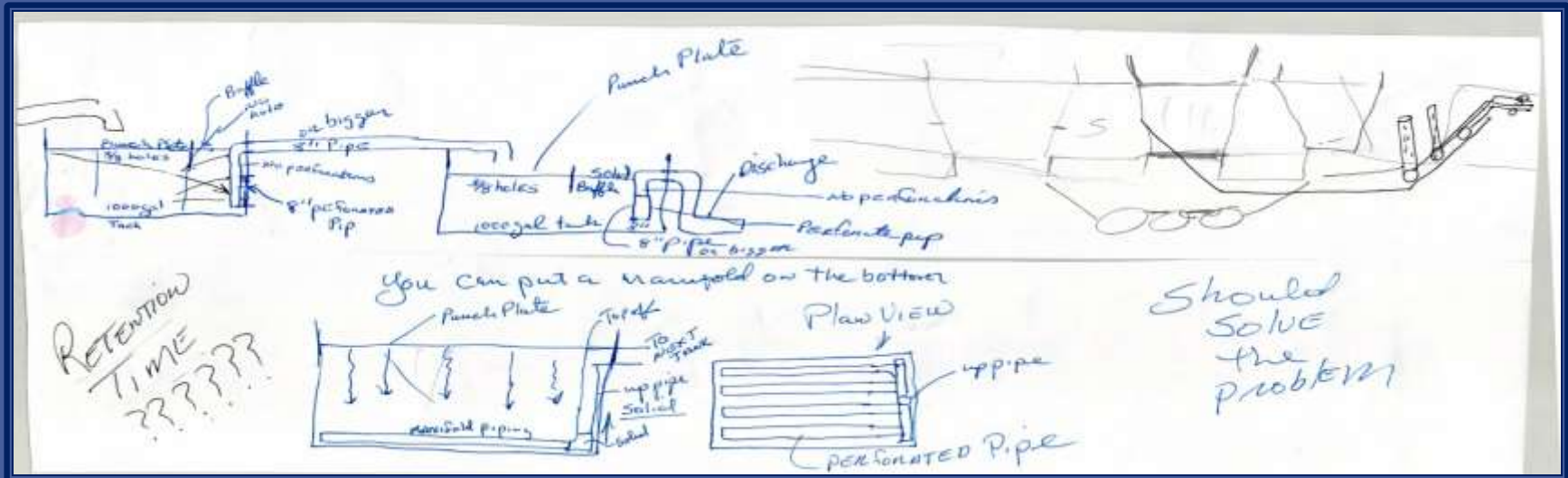
Sample	Time Min.	Raw Mn	Zeo-Mn	Net Mn	Raw Na	Zeo-Na	Raw Mg	Zeo-Mg	Raw Ca	Zeo-Ca
13	60	2.65	1.19	-1.46	2.99	16.09	30.10	21.96	51.25	62.22
14	90	2.65	1.16	-1.49	2.99	17.04	30.10	22.02	51.25	63.12
15	15*	2.65	0.82	-1.83	2.99	25.42	30.10	21.17	51.25	68.74
16	60	2.65	1.06	-1.59	2.99	17.43	30.10	21.19	51.25	60.51
17	90	2.65	1.16	-1.49	2.99	17.73	30.10	22.27	51.25	62.67
18	60	2.65	1.28	-1.37	2.99	15.05	30.10	22.43	51.25	60.37
19	90	2.65	1.30	-1.35	2.99	15.06	30.10	22.51	51.25	61.11
20	90	2.65	1.34	-1.31	2.99	14.94	30.10	22.92	51.25	60.67
21	120	2.65	1.08	-1.57	2.99	23.36	30.10	23.41	51.25	67.09
22	24*	2.65	0.94	-1.71	2.99	28.71	30.10	24.23	51.25	86.29
23	100	2.65	1.21	-1.44	2.99	20.14	30.10	23.32	51.25	75.97
24	90	2.65	1.31	-1.34	2.99	17.89	30.10	23.43	51.25	72.99
25	120	2.65	1.35	-1.30	2.99	16.10	30.10	23.32	51.25	70.71

15* & 24*--Hours not Minutes

TEST 5-Renew Zeolite ???

Sample	Time	Raw Mn	Zeo Mn	Net Mn	Raw Na	Zeo Na	Raw Mg	Zeo Mg	Raw Ca	Zeo Ca
Saline 1	16*	.04	22.65		28050	13,491	1.34	551.85	27.45	4,420.50
Saline 2	48*	.04	10.65		28050	21,750	1.34	362.70	27.45	4,198.50
Saline 3	60**	.04	3.00		28050	26,100	1.34	106.50	27.45	1,414.05
Saline 4	120**	.04	1.65		28050	27,315	1.34	55.80	27.45	791.55
Saline 5	24*	.04	2.55		28050	25,485	1.34	280.65	27.45	3,865.54
Saline 6	18*	.04	8.90		28050	17,880	1.34	203.45	27.45	1,432.00
26	30**	2.56	0.93	-1.63	2.21	2,984	29.77	31.50	55.52	277.20
27	45**	2.56	0.75	-1.81	2.21	1,982	29.77	19.49	55.52	127.70
28	45**	2.56	0.56	-2.00	2.21	1,182	29.77	11.42	55.52	55.91
29	30**	2.56	0.47	-2.09	2.21	673	29.77	7.90	55.52	27.51
30	30**	2.56	0.41	-2.15	2.21	497	29.77	6.32	55.52	18.23
31	30**	2.56	0.27	-2.29	2.21	491	29.77	4.27	55.52	12.14
32	30**	2.56	0.29	-2.27	2.21	310	29.77	4.42	55.52	9.97
33	30**	2.56	0.31	-2.25	2.21	248.50	29.77	4.24	55.52	8.09
34	30**	2.56	0.28	-2.28	2.21	197.80	29.77	3.94	55.52	6.99
35	30**	2.56	0.34	-2.22	2.21	170.30	29.77	4.49	55.52	7.69

ZEOLITE PRACTICAL APPLICATION



ZEOLITE PRACTICAL APPLICATION



ZEOLITE PRACTICAL APPLICATION



ZEOLITE PRACTICAL APPLICATION



ZEOLITE PRACTICAL APPLICATION



NOT--Zeo What ?????

ZEO WOW