



**GEOCHEMISTRY TEAM**

Nicole Lautze - lautze@hawaii.edu

Diamond Tachera - diamondt@hawaii.edu

**MICROBIOLOGY TEAM:**

**@labhulofrank**

Kiana Frank - kifrank@hawaii.edu

Sheree Watson - shereew@hawaii.edu

Ku'i Keli'ipuleole - melaniek@hawaii.edu



UNIVERSITY  
of HAWAII  
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@labhulofrank



# NUTRIENTS

can naturally occur and or increased by man-made sources

## - Nitrogen -

MOST COMMON!!  
HIGH VALUES = HUMAN



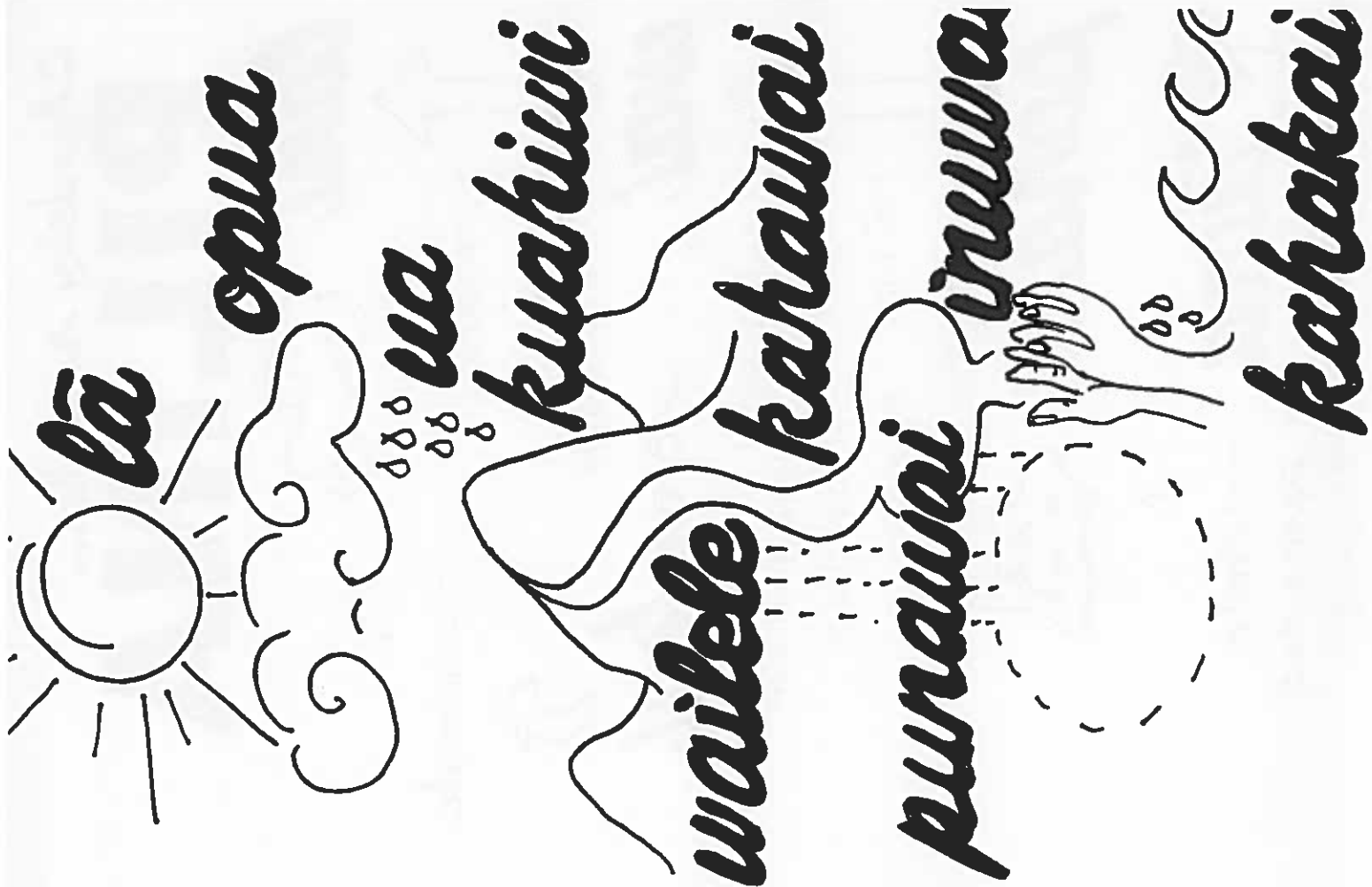
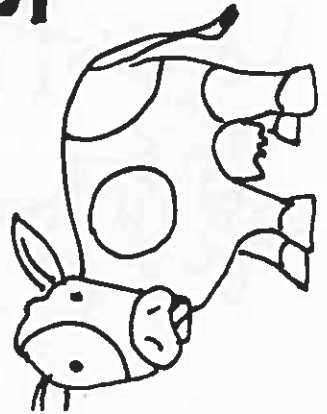
## - Phosphorus -

from WEATHERING of ROCKS  
elevated levels from FERTILIZER



## - Sulfur -

Low from natural sources  
HIGH from use of agricultural and household FERTILIZER

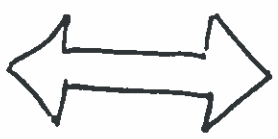


Chemistry reveals...

# PILINA

lani ☁

+ oxygen



- radon

+ chloride



wai ↙ see hoi ↘

+ calcium

+ iron

+ Silica

+ radon

+ magnesium

+ manganese

+ Boron

pohaku



āina

+ potassium

+ nitrate

+ pesticides

+ Arsenic

## Major Ions



Chloride



originates from evaporated SEAWATER

used to TRACK FLOW PATHS

because doesn't change



Calcium

from dissolution

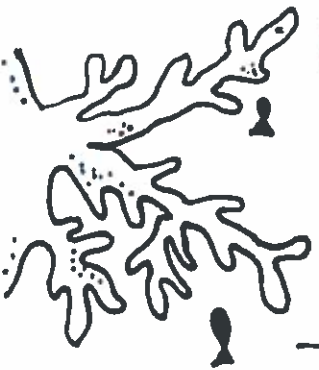
of carbonate

ROCKS, SHELLS, FOSIL

High levels = HARD

WATER

Binds to CLAY



N<sup>3+</sup>  
Sodium

influence TASTE  
From breakdown  
of clay minerals  
or marine deposits

~ hoi ~

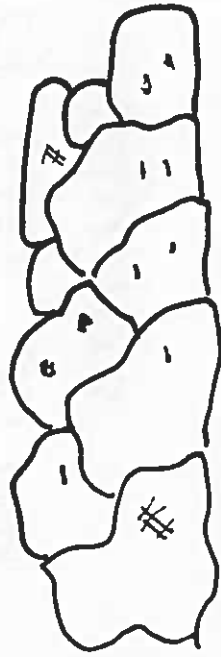
# Trace Metals

$Fe^{2+}$   
Iron  
Oxide = orange → RUST  
Seasonal  
ROCK-WATER INTERACTIONS ↓

↑ Derived from natural  $MIN^{2+}$   
Oxide = BLACK  
Manganese  
↑↑ influenced by landfills  
↓↓ by treatment

$SiO_2$   
Silica  
COMMON mineral in ROCKS  
Correlated with AGE of groundwater

from the breakdown of Boron minerals  
B  
Boron



flow

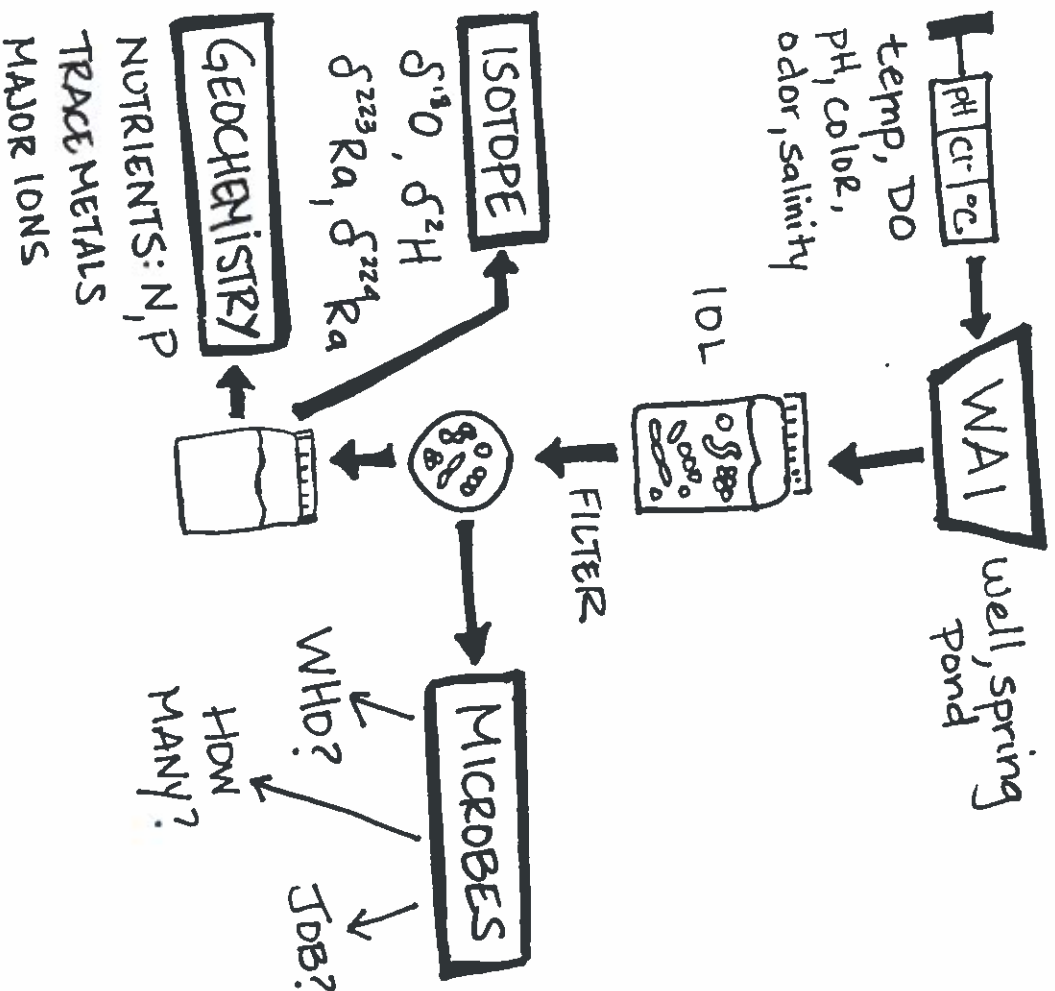
source

flow

quality

# METHODS:

## ho'ā'ō ka wai

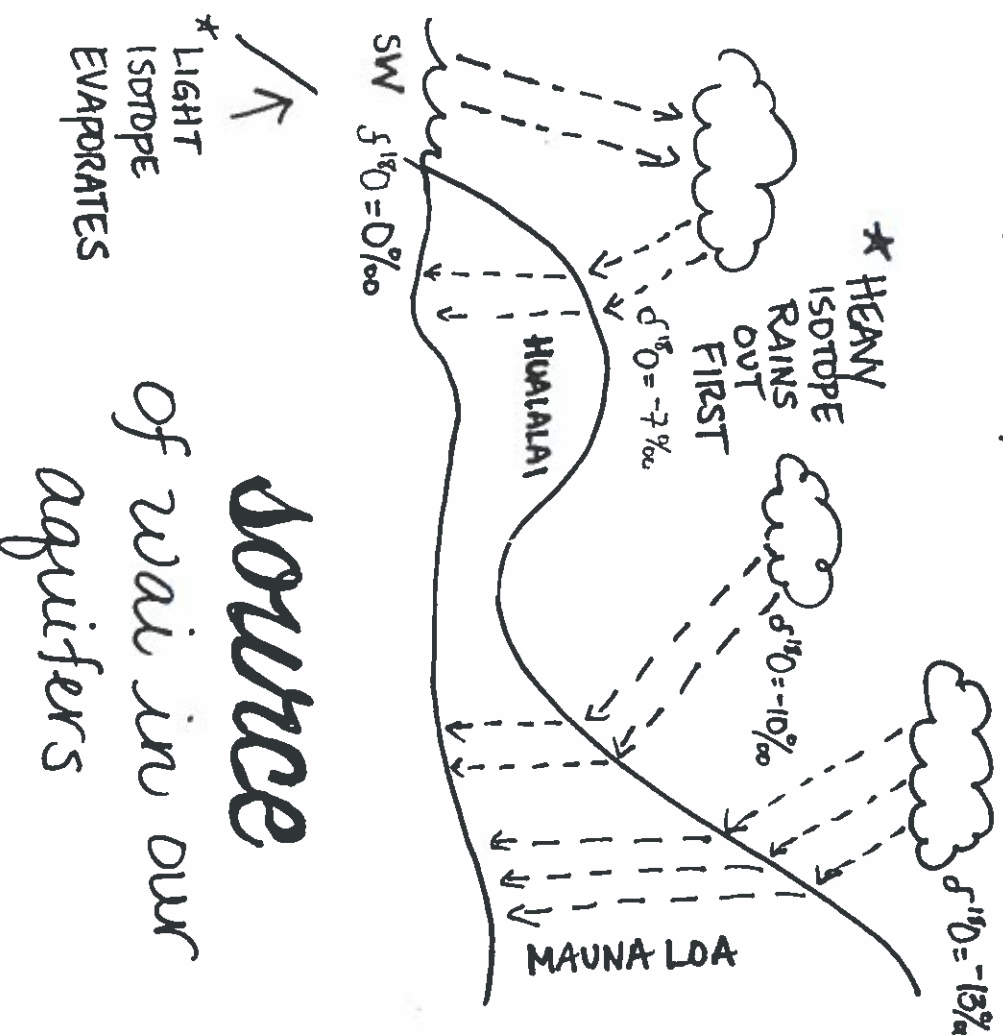


# Isotopes

## hānau ka wa

HEAVY WATER  
 $> H_2^{18}O$   
 $= \delta^{18}O = 0\text{‰}$

LIGHT WATER  
 $> H_2^{16}O$   
 $= \delta^{18}O = -13\text{‰}$



source of wai in our aquifers