

# Comparing the flavors and characters of spring water based on local geologic variation in the Tamba Kasuga area



Group6

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# Motive

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Spring water in Kasuga, Tamba, Hyogo prefecture is used by local people. It is said to be delicious.

Why?

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# Purpose

- To reveal what physical characteristic of Kasuga water makes it delicious.
- To research what environmental factors give it that characteristic.



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# Keywords



- 1. Delicious water**
- 2. Hexagram**
- 3. Accretionary Prism**
- 4. Sr isotope ratio**

# Keywords



**Delicious water**

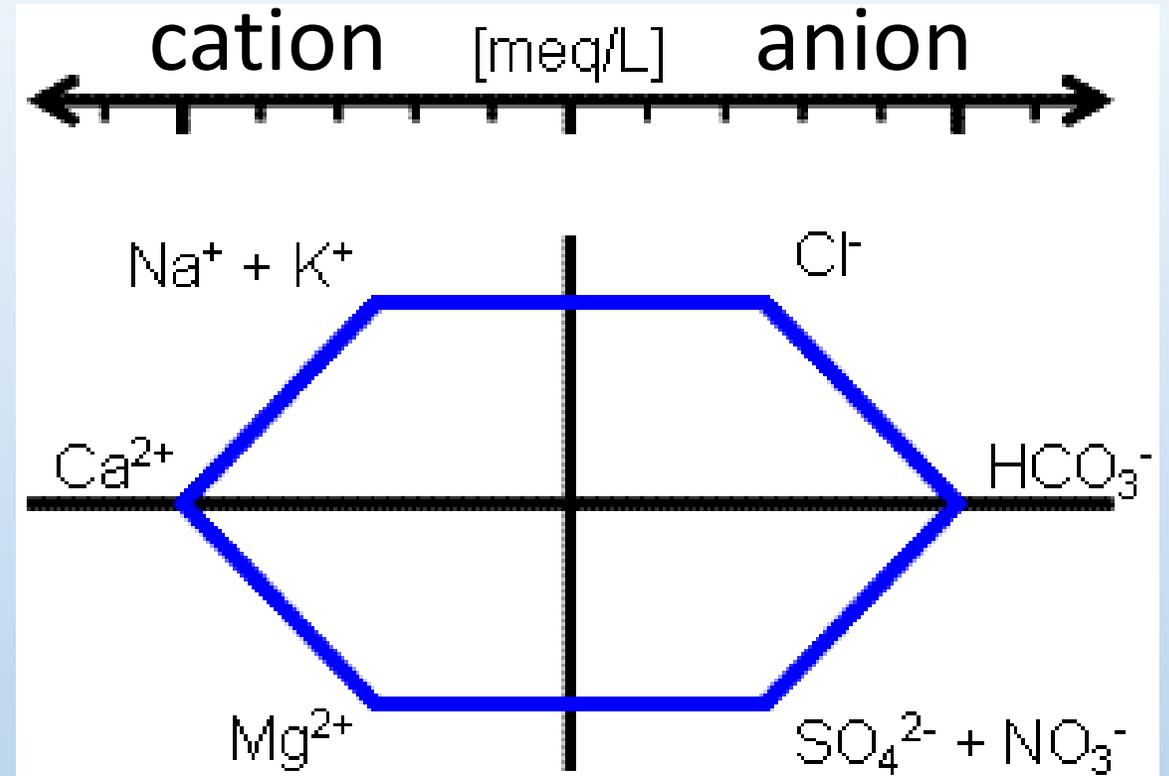
# Requirements of delicious water released by the Ministry of Welfare in Japan

item	Requirements	summary
Residue on evaporation	30 ~ 200 [mg/L]	Mineral content
hardness	10 ~ 100 [mg/L]	Ca and Mg content
Free carbon dioxide	3 ~ 30 [mg/L]	Gives water refreshing taste , but too much free carbon dioxide isn't good
Potassium permanganate	under 3 [mg/L]	Amount of inorganic substance
Degree of odor	under 3	Feel unpleasant taste if numerical value is high
Residual chlorine	under 0.4 [mg/L]	Give water taste of chlorine
Water temperature	under 20 [°C]	delicious when cold

# Keywords



# Hexagram

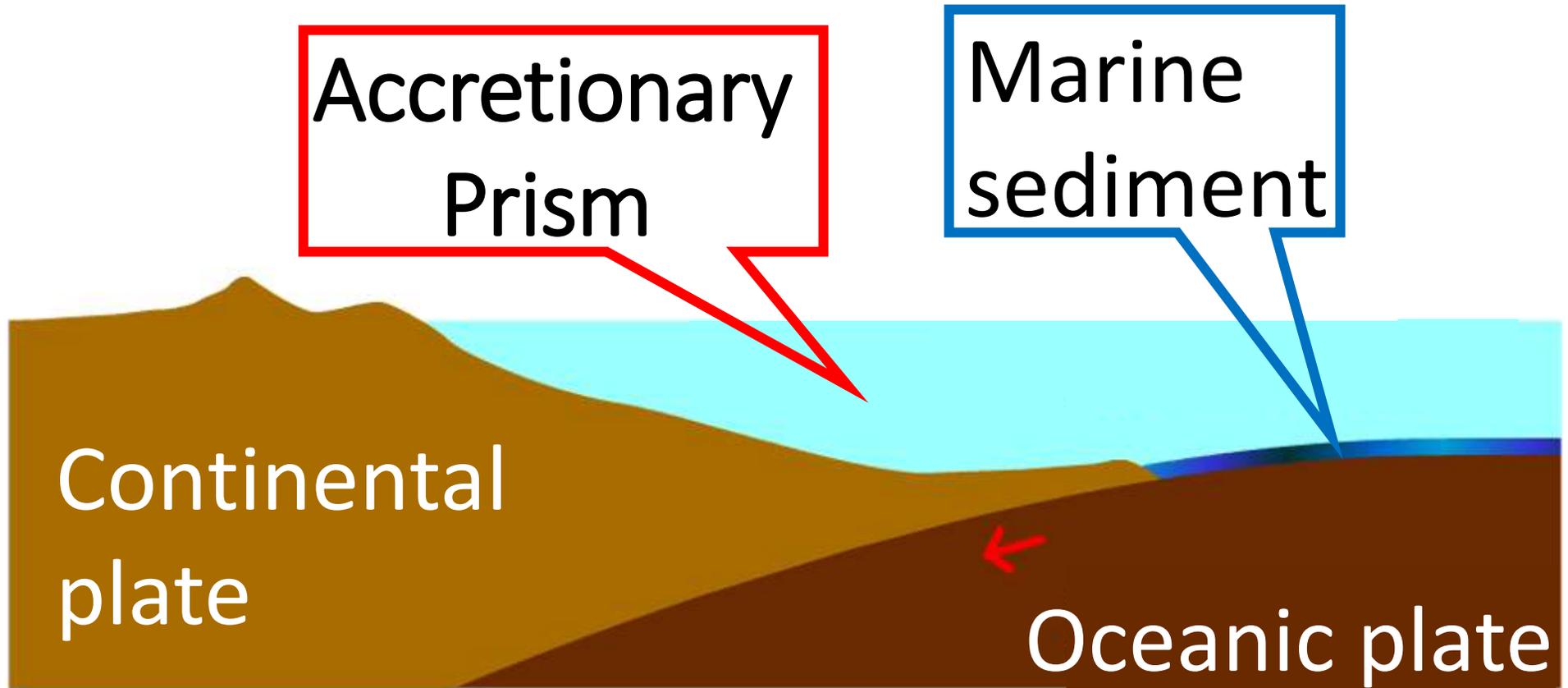


Plot the concentrations of various ions found in water on the horizontal and vertical axes, and connect each point.



# Accretionary Prism

# Accretionary Prism

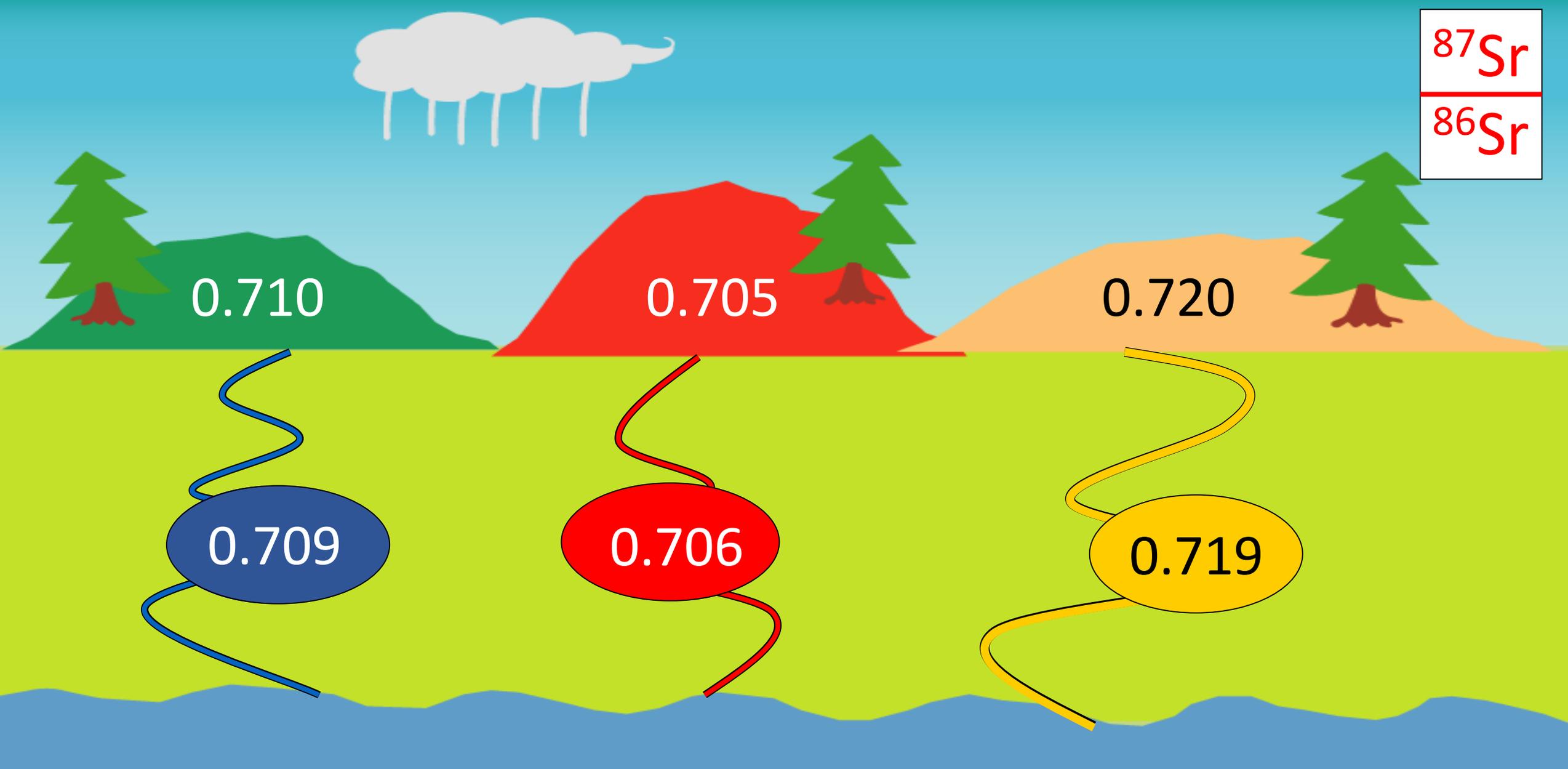
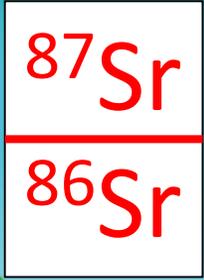


## Accretionary Prism

# Keywords



**Sr isotope ratio**  $\frac{{}^{87}\text{Sr}}{{}^{86}\text{Sr}}$



sea:  $0.709175 \pm 0.000005$

Reference to Research Institute for Humanity and Nature  
Emeritus Professor Mr. Nakano Takanori

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# Water introduction

① Kasuga Water

② *Oishiimizu*  
*Rokko*  
(bottled water)

30km 



# Tasting

## <Method>

- 117 students and teachers at our school.
- Evaluation on a scale of one to five of Bitterness, Acidity, and Deliciousness
- As a target for comparison, we use *Oishiimizu Rokko*.

bitterness	Weak 1 · 2 · 3 · 4 · 5 Strong
acidity	Weak 1 · 2 · 3 · 4 · 5 Strong
deliciousness	Good 1 · 2 · 3 · 4 · 5 Bad

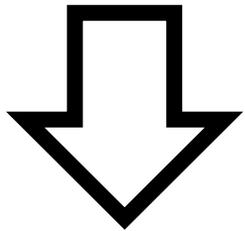


# Tasting items

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## Hardness

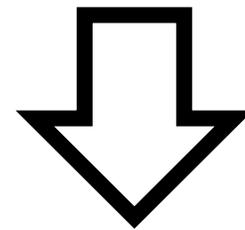
Contents of Ca and Mg  
The **higher** a value is, the **more bitter** it is.



**bitterness**

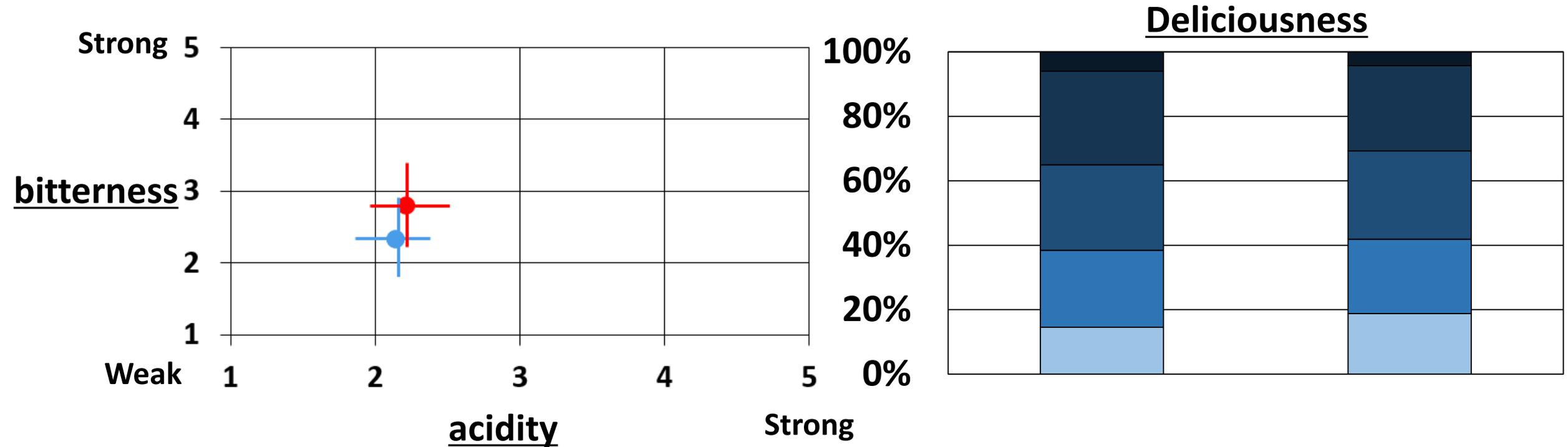
## Free carbon dioxide

Gives water refreshing taste ,  
but too much free carbon  
dioxide is not good.



**acidity**

# Tasting Results



● Kasuga Water ● *Oishiimizu Rokko*

Comparing the results, there are little difference as a whole .  
Thus, Kasuga Water is as delicious as *Oishiimizu Rokko*.

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# Analysis Lists

- pH

- Hardness

- Ion Concentration

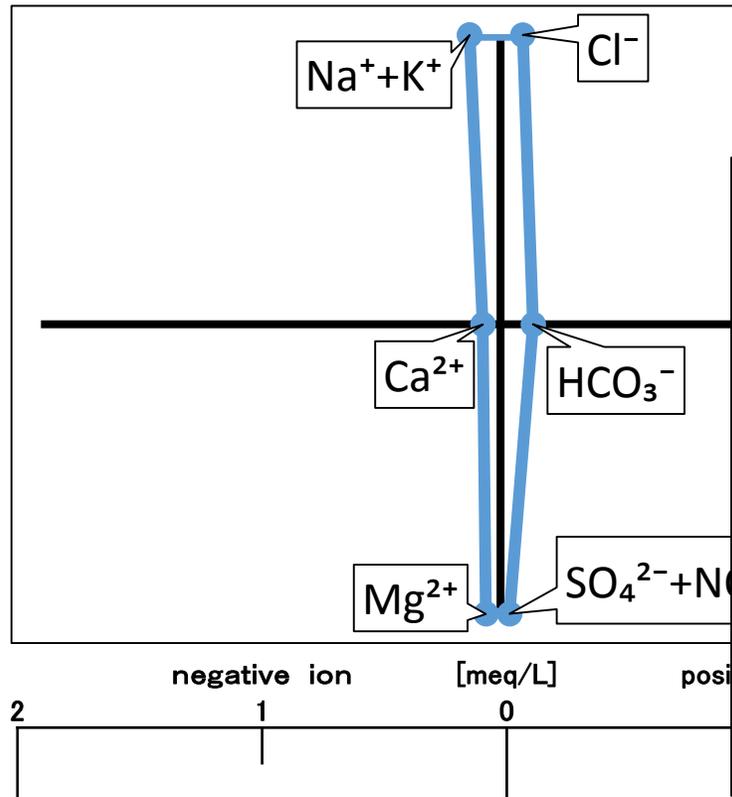


# Results

## ① Kasuga Water

pH: 6.5

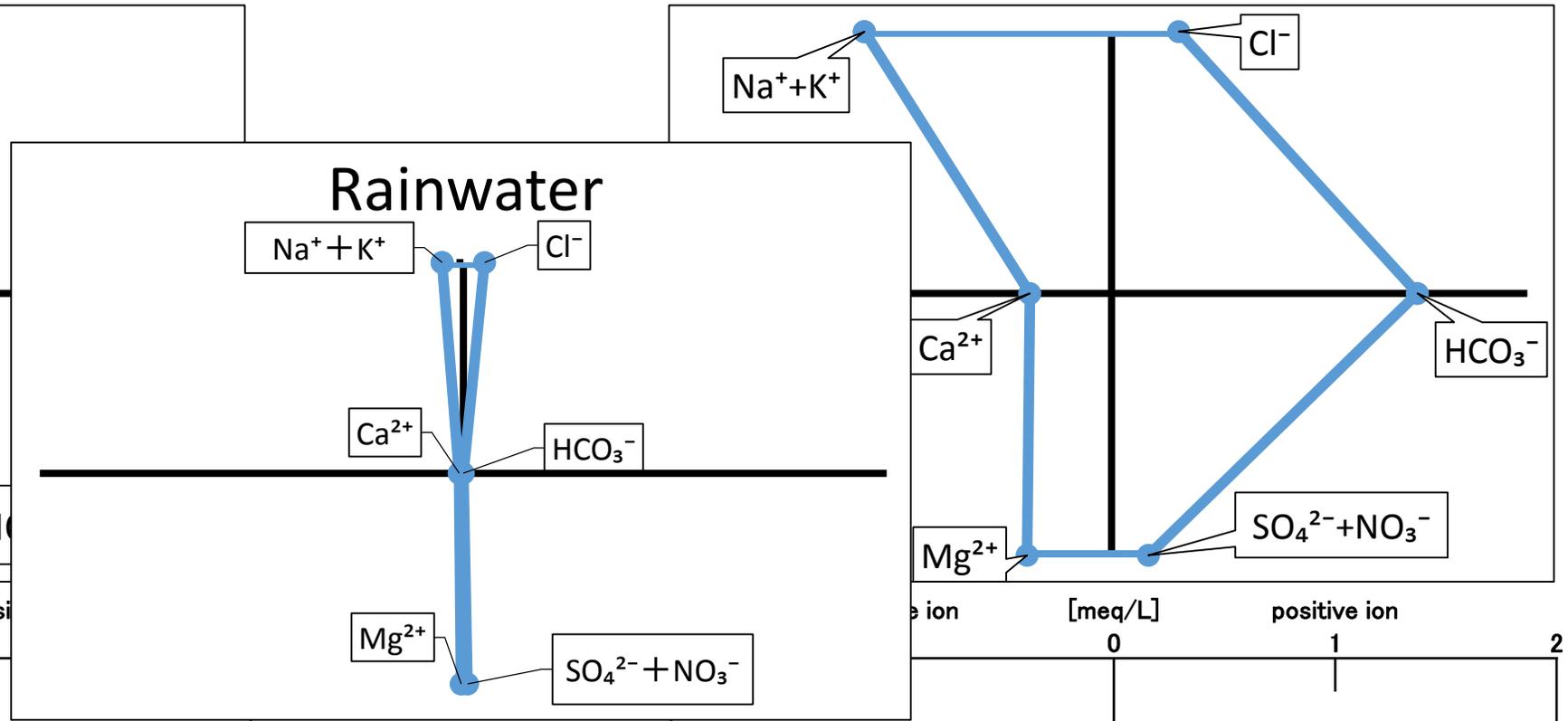
Hardness: 5.4mg/L



## ② Oishiimizu Rokko

pH: 7.0

Hardness: 32mg/L





① Kasuga Water

The image shows a detailed geological map of a region, likely in Japan, characterized by various colored zones representing different geological formations. A red dot marks the location of 'Kasuga Water' in the upper-middle section, and a blue dot marks 'Oishiimizu Rokko' in the lower-middle section. A scale bar in the bottom-left corner indicates 20 km. The map includes labels for '高砂' (Takanosato) and '市' (City). In the bottom-right corner, there is a copyright notice: 'シームレス地質図 (許) 地図データ ©2017 Google, ZENRIN 利用'.

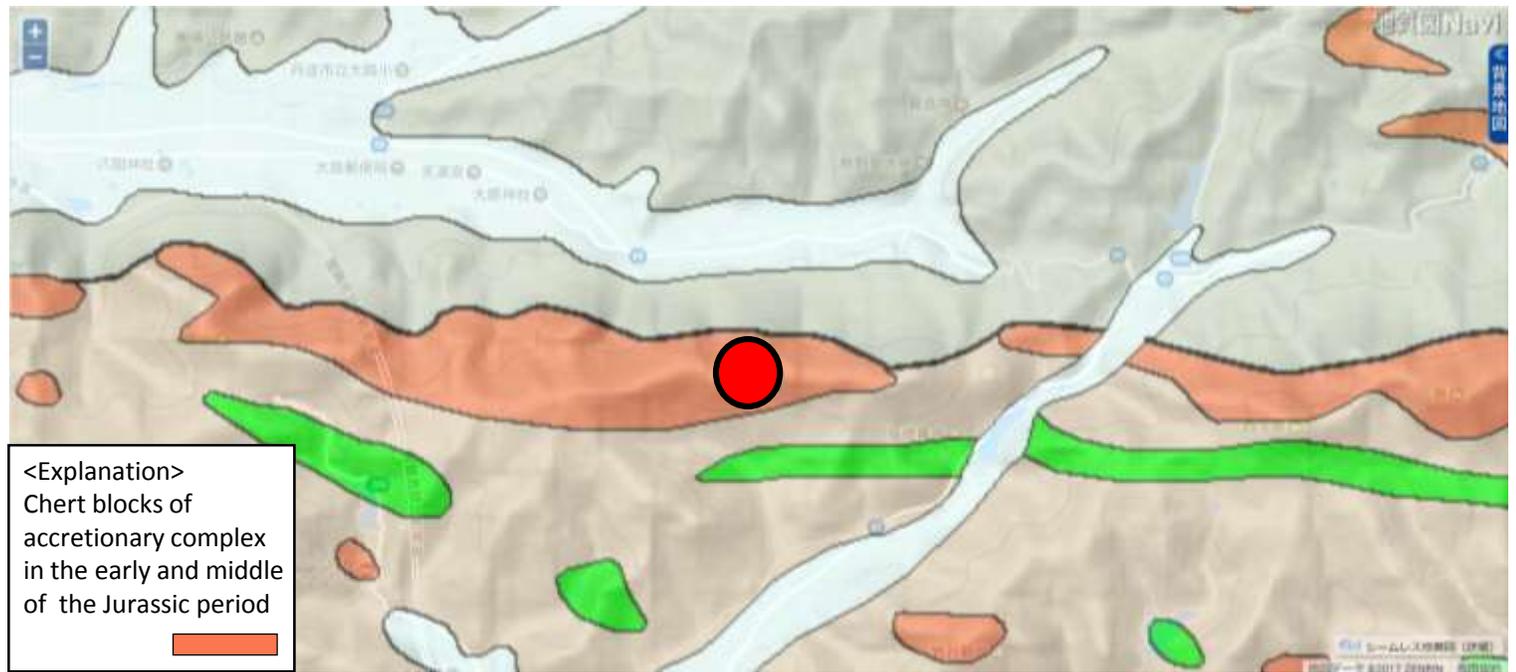
② Oishiimizu Rokko

20km

# Kasuga Water

geology: chert

2.5km 

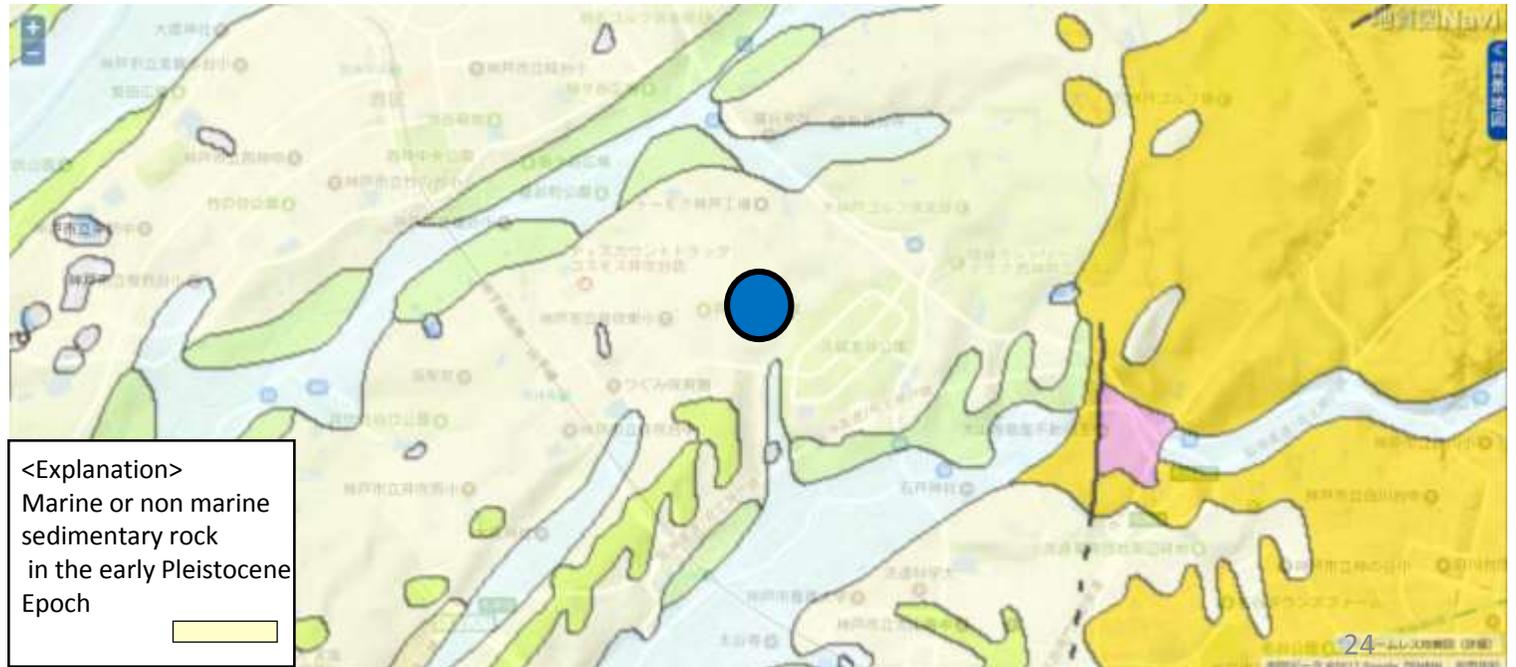


# Oishiimizu Rokko

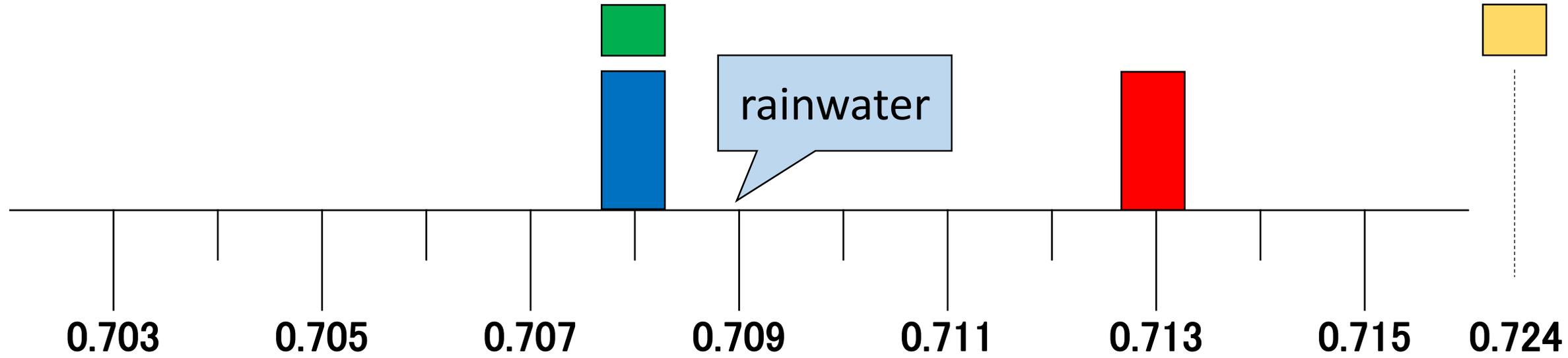
geology:

Non marine sedimentary rock

2.5km 



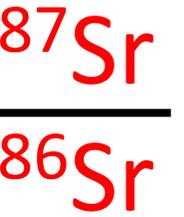
# Sr Isotope ratio



	<i>Oishiimizu Rokko</i>	Kasuga Water
Sr isotope ratio of water	0.708	0.713
Sr isotope ratio of rocks	0.708	0.724

non-marine  
sedimentary rock

chert



0.708

0.724

*Oishiimizu  
Rokko*

Gravel layer

*Kasuga  
Water*

0.708

0.713

$0.709175 \pm 0.000005$

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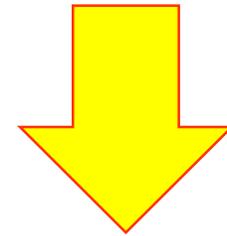
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# Chert



A rock which resists  
weathering



Ions are hard to dissolve

# Conclusion

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What makes it delicious

- pH: weak acid
- low hardness
- low concentration of ions  
(by hexagram)

The environmental factor  
behind this

- Accretionary prism  
which contains chert  
(by Sr isotope ratio &  
nature of accretionary prism)

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# Future plans

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- research what environmental factor causes *Kasuga water's* weak acidity
- research *Gokosui* in Fushimi, Kyoto in detail  
(The geological features of the place where water is collected is the same as Kasuga water.)

# Future plans

Research what environmental factor causes *Kasuga water's* is weak acidity



We measured CO<sub>2</sub> concentration in Kasuga, Tamba.



<method>

- ① put air in the plastic bag
- ② put in the detecting tube
- ③ wait two minutes

# Future plans

Research *Gokosui* in Fushimi, Kyoto in detail



We did fieldwork.

- fetch water
- analyze

# *Gokosui* and other water

	① Tamba Kasuga	② <i>Oishiimizu Rokko</i>	③ <i>Gokosui</i>
pH	6.5	7.0	5.8
Hardness(mg/L)	5.4	32	39~44
Sr isotope ratios	0.713	0.708	0.710

<Result>   ▪ pH: weak acid   ▪ Sr isotope ratios: higher than normal  
▪ Hardness: similar to *Oishiimizu Rokko*

# References

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# Special thanks

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- Adviser: Okayama University, Graduate school of Natural Science and Technology, Associate Professor Katsuyuki Yamashita
- Adviser: Research Institute for Humanity and Nature , Professor Emeritus Takanori Nakano
- Cooperation : Okayama University, Department of Earth Sciences  
Mr. Osamu Okano, Ms. Mayuri Inoue
- Guide in Tamba: former council member Mr. Tadanori Yamamoto  
former deputy mayor Aogaki town Mr. Hajime Adachi

**Thank you very much!**



Thank you for listening!



# What is ICP-OES ?

A type of spectroscope which can detect trace metals.



## Way of checking

It carries a liquid to check in a thin tube.

- Samples temperature reach higher than 6,000 degrees Celsius by the voltage of the coil.
- A liquid is sprayed on inductive coupling plasma (ICP) of 5500K.
- The atoms in the sample are excited.
  - atoms and ions release characteristic wavelengths.