

Science Lecture at PCSHS NST

What is science?

And some model experiments

Lecture by Yoshio Okamoto

PCSHS Nakhon Si Thammarat on 19th Dec. 2022

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Who a

- Earth science high school teacher
- Study at a teacher training college
- Associate professor and part-time lecturer at Osaka-Kyoiku University 2002-2004
- Earth Science visiting teacher at PCSHS Mukdahan in 2005
- **School seismograph system (this year: PCSHS Loei)**
- **3D seismicity map**, tsunami
- **Polarized microscope unit &**
- Linux Programming (awk, C, Perl)
- 3D printing (2019-)

Yossi-Okamoto.Net

Teaching Tools Publish Resources Field Trip(World) Field Trip(Japan) Essay etc.

0:10:45.0
RAVS-COUNTER.COM
Teaching Tools. Feel Free to Use with Copy Left! (GNU).
日本語はこちら

What's New (20th August 2022)

- 20th Aug. 2022 **for the GeoSciEdIX** Page Open **New!**
- 04th Aug. 2022 **My Lecture_menu** Page Open **New!**
- 03rd July 2022 **KVIS_Seismograms** Page Open **New!**
- 06th June 2022 **Geology Videos** **New!**
- 29th May 2022 **JpGU_2022ePoster** **New!**
- 11th Feb. 2022 **Rock-Thin Section and Polarized Unit (EER2021)**
- 30th Jan. 2022 **A barometer** for micro pressure changes
- 27th Jan. 2022 **for the 5th KVIS-ISF**
- 3rd Jan. 2022 **Wegener's Puzzle**
- 26th Dec. 2021 **2022Calendar**
- 14th Sep. 2021 **Rock Thin-section Page**
- 21th Aug. 2021 **Making printed circuit board**
- 17th June 2021 **2021 Rock Thin-Section Page**
- 2nd May 2021 **Rocks of the trip to South Africa Barberton 2010**
- 23th Apr. 2021 **The 4th KVIS-ISF teacher show**
- 23th Feb. 2021 **Rock thin-section library**
- 12th Feb. 2021 **3D printer products**
- 04th Feb. 2021 **Seagull Factory teaching materials**
- 23th Jan. 2021 **Some teaching materials are updated below**
- 22th Jan. 2021 **Uploading the resources for the 4th KVIS-ISF**

Presentation Resources

- for the GeoSciEdIX**
- for the 5th KVIS-ISF**
- for the Earth Educators' Rendezvous 2021**
- for the 4th KVIS-ISF**
- for IGC36 delegates**
- for KVIS students**
- for HS students**
- for PCSHS Mukdahan students_2019 and WS**

Seagull Factory

Tools for Classroom



A Noble
No tears
Crazy

Tennoji High school attached to Osaka-Kyoiku University

A novel prize winner of our graduate



- Shinya Yamanaka 山中伸弥
- The 2012 Nobel Prize for Physiology or Medicine
- for the discovery of iPS cells.



A week plan (a tentative plan)

- Seismograph and seismogram
- How to identify rocks (Some school rocks)
- What is a polarized microscope?
- How to observe thin-sections
- Volcanic ash observation and FOB pumices
- What does volcanic ash reveal?
- Questions and discussions

Overview of today's class (13h - 15h)

- Self-Introduction
- What is science?
- My iPhone XV?
- Some model experiments by our HS students
- Questions and Answers

My policy! for science education

- I will show you **two videos** of the volcanic eruptions.
- What is the **fundamental difference** between the two videos?

1991 Unzen Pyroclastic Flow



A Day in Pompei AD79

24 AUGUST 79 AD



Comparison of two videos

- Real (Fact) VS. CG (Artificial)
- Low-resolution High-resolution

1991 Unzen Pyroclastic Flow



- Fact

Science is based on!!

- Artificial (Fake)

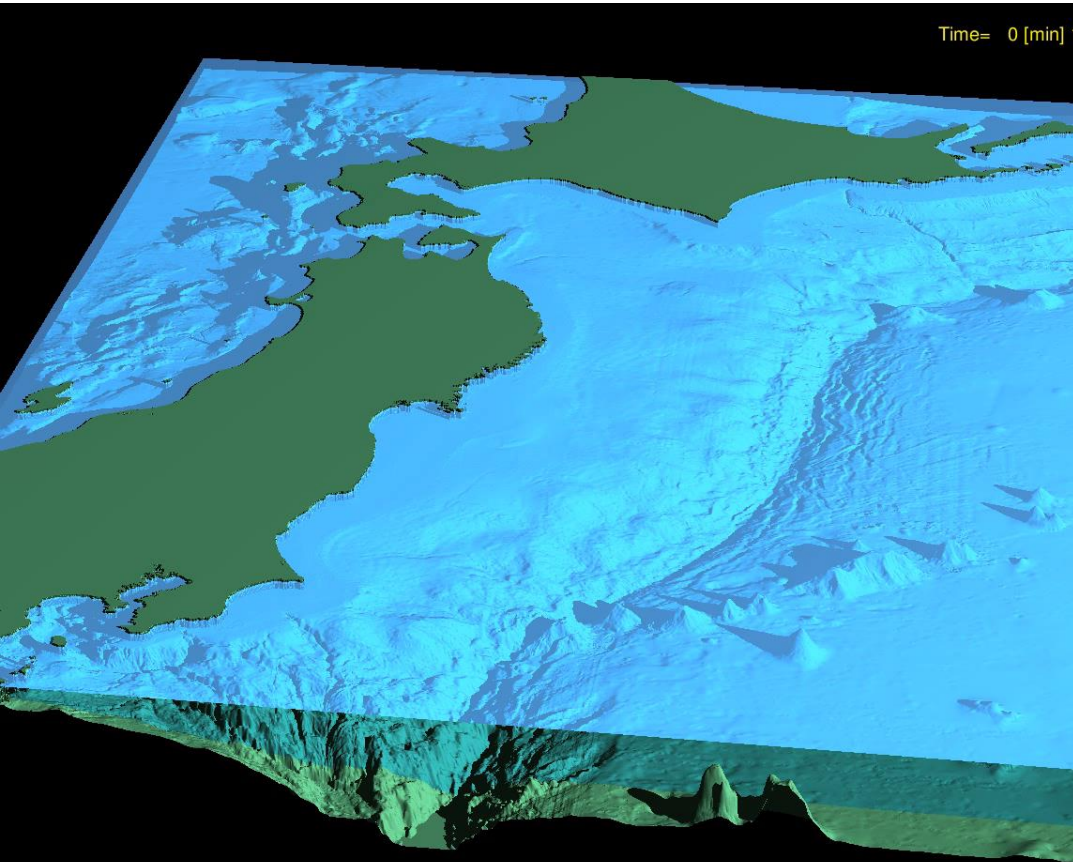
What I most emphasize in science education

- The original data
 - > How to get them
- The mechanism of sensors or recording systems that you use.
- Because, in science festival, the students treat a lot of data in their presentation, however, **only a few students comprehend how their data are collected and where come from.**
- This is because the most of **ICT devices are “Black-Box”**, so students can not understand the mechanism inside.

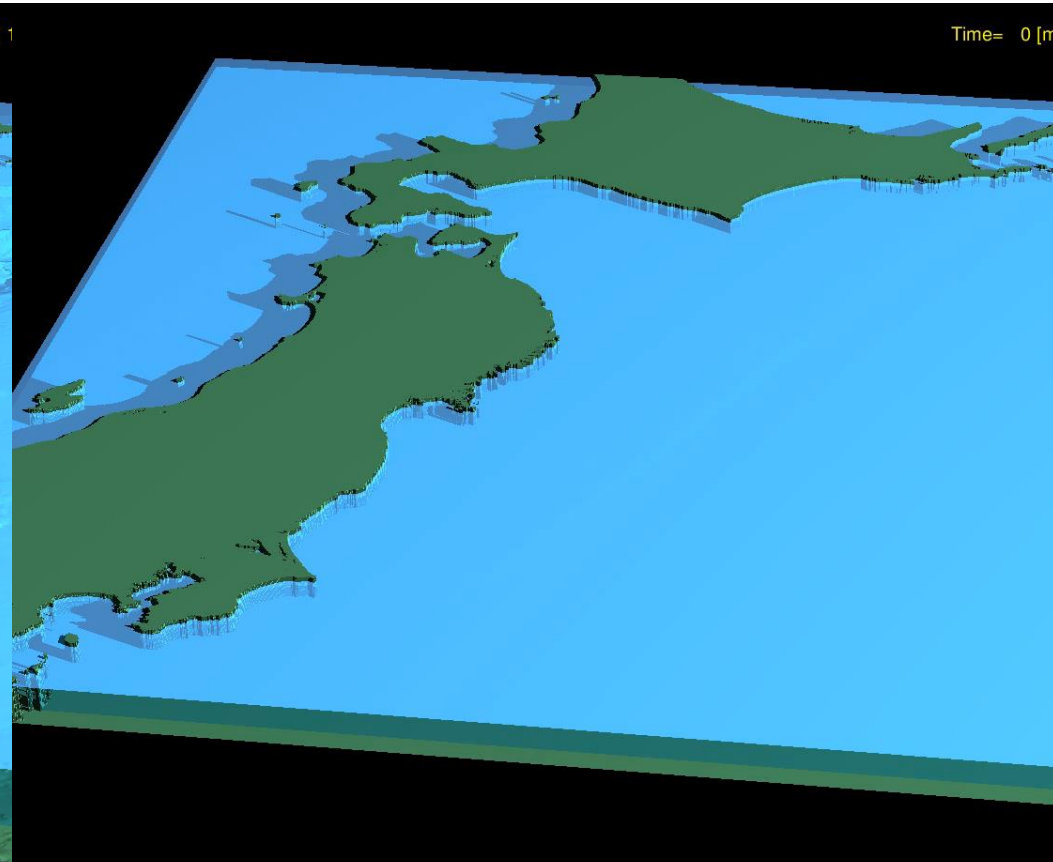
Caution!

- I do not think “ICT” devices are not suitable for education.
- Because I already use a lot of ICT devices in my teaching tools; Arduino, Raspberry Pi, M5Stack, or ICT sensors.
- Also I made a lot of simulations about nature;
I will show you some;

Tsunami simulations by me



東北津波 Simulation v2 by Y.Okamoto 5th Apr. 2011



東北津波 Simulation on flat sea floor -1500m by Y.Okamoto 29th Mar. 2011

What I recommend to my students

- Make your tool to measure something in nature.
- **Simple and primitive** device is better.
- From this experience, the students know how **the data are contaminated with “noises” or distorted.**
- **Making measuring devices by hand gives the students important skills and wide viewpoints for science.**
- High-tec tools and super-low-tech tools are both important!
- So, I always said to my students; make a simple device and get data, after that, you can use PC or high-tech tools.

I recommend “model experiments”

From http://seagull.stars.ne.jp/2006_Germany/model-based777.pdf

- **Nature: Complicated**
- **Some fundamental features to extract from natural phenomenon**
- **Simplified the fundamental features -> “Model”**
- **Build your own model using daily materials**
- **Measure two parameters using high-tech tools**
- **Make a graph of two parameters**

Examples_1 *Using sugar sweets!*



Fig1. Sugar calmera as a mimic of basalt lava



Fig2. Sugar candy models cool joints of lava flow

Examples_2 *Karst related*



Fig3. Stalactite using Sodium thio-sulphate($\text{Na}_2\text{S}_2\text{O}_3$) aqua.

カルスト地形

1年A組 木村 優花
白江 素子
藤野 翔香

操作方法

ホウ酸、ホウ砂、炭酸水素ナトリウム、砂糖、片栗粉、食塩をそれぞれ量り容器に入れ霧吹きで水をかける。

③ これはホウ酸でじっぴんして写真のある汁で一番カルストっぽくなりました。

④ ホウ酸と炭酸水素ナトリウムを混ぜてみました！！なんと！！食塩が析出しました！！！！上手く塩が析出したらカルストっぽくなりました！！！！

⑤ これは片栗粉で作ったカルスト地形ですがすぐに固まってしまい塩析物に変わってしまいカルスト地形っぽくはならなかった

☆結果☆

ホウ砂はサラサラしていて固まりにくいのでむかない。砂糖はドロドロになるだけで固まりにくかった。ホウ酸は適度に固まりやすい。炭酸水素ナトリウムとホウ酸を混ぜたのはカルスト地形とさうより化学反応が起きてしまい綺麗っぽくなりました。

Fig4. Doline like surface using powder and spray.

Examples_3 *Mirage in water and geyser*

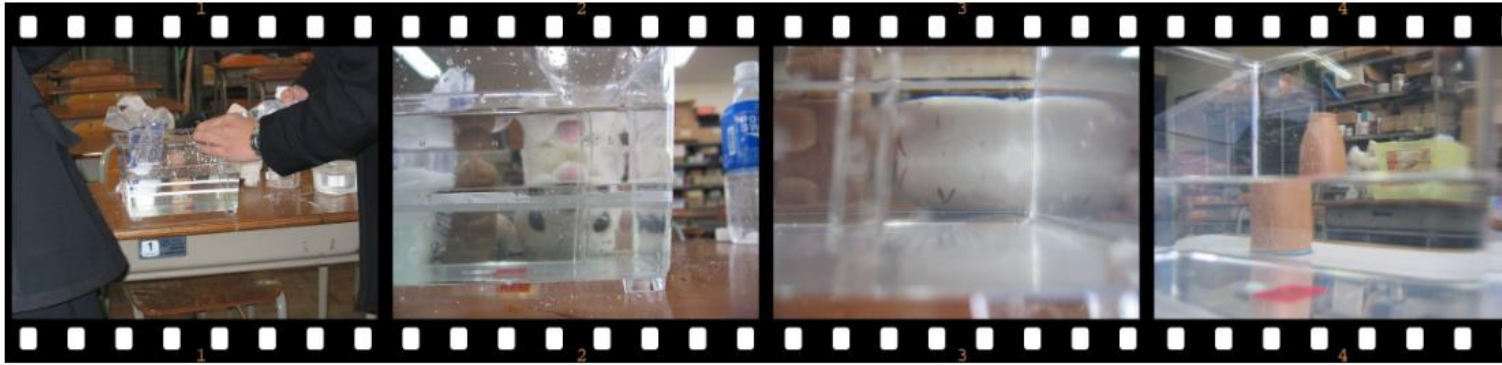


Fig5. Mirage in a fish tank using sugared water.

<https://educalingo.com/ja/dic-fr/mirage>

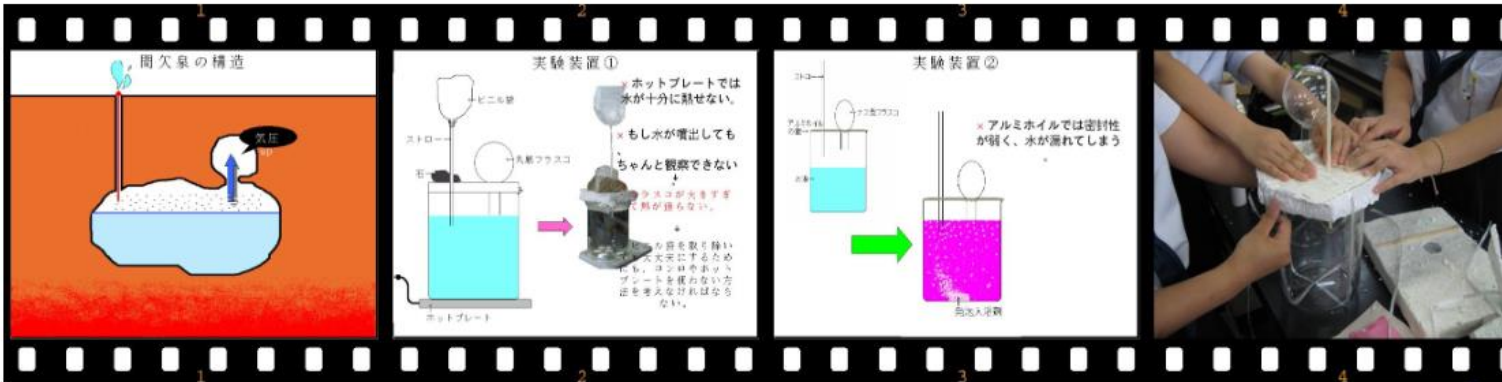


Fig6. A geyser model using a beaker and a flask.

<https://yellowstone.net/geysers/>



Example_4 *Plate tectonics*



Fig7. Plates collision (Himalayan orogen model with flour).

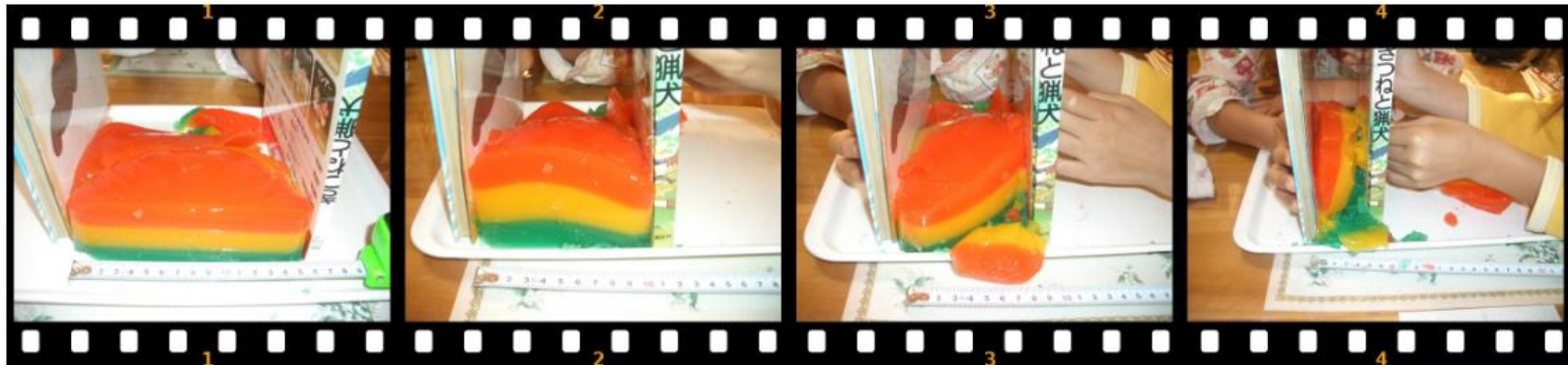


Fig8. A gelatin reverse fault failed.

Example_5 *Volcanic eruption*

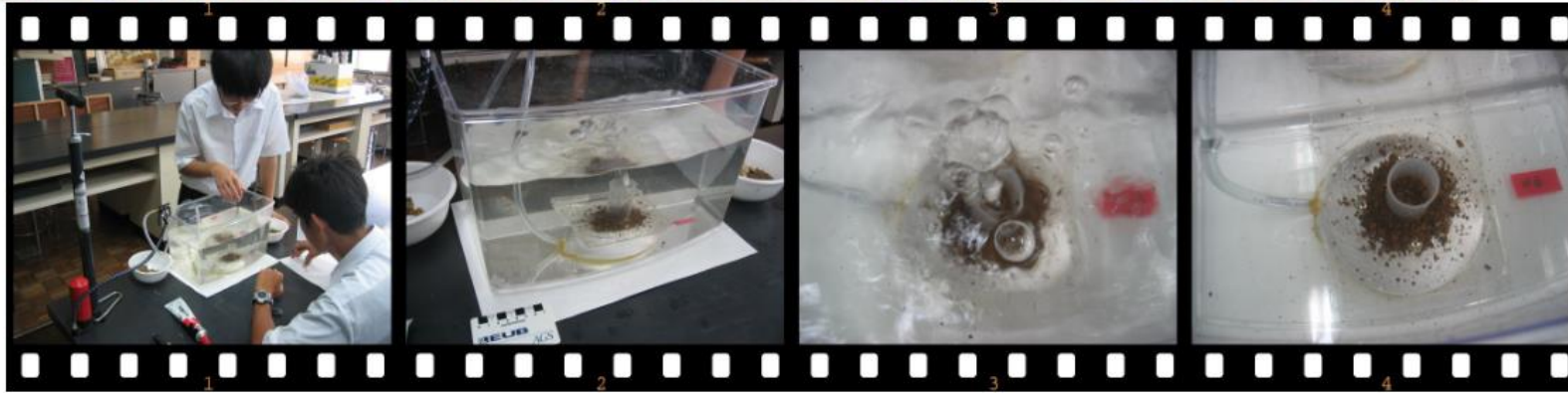


Fig9. Water bottom volcano showing inverse distribution of pumice.



Fig10. A Video capture of a bath sparkler and hot water volcano.

Model experiment and data analysis

例その5: 火山噴火関連

Ocean floor volcano

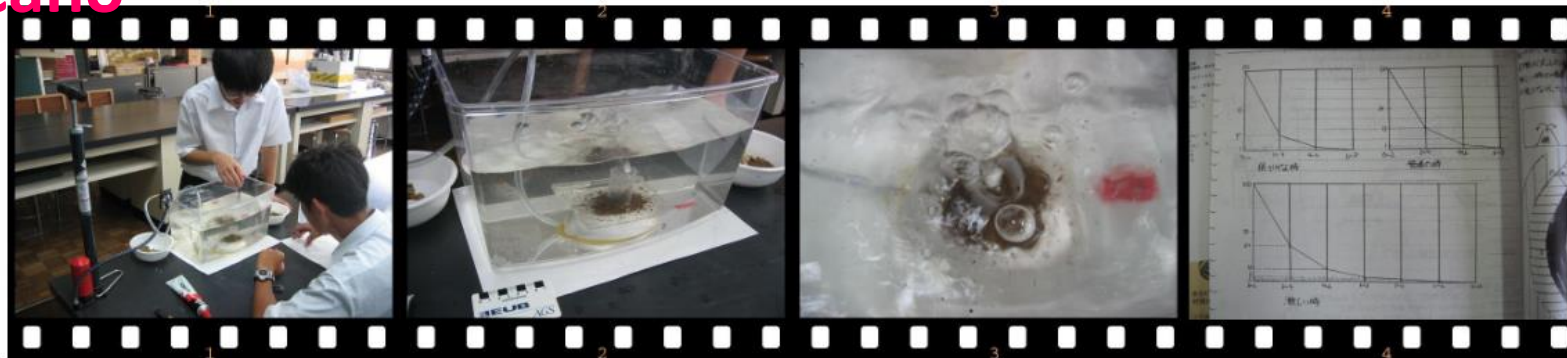


図9. 水槽の底の火山噴火. 噴出物の密集度を距離の関数で表現.

Bath bomb and eruption heights



図10. バブとお湯による噴火実験. 噴水の高さが温度に比例.

Example_6 *Pyroclastic flow in a water tank*

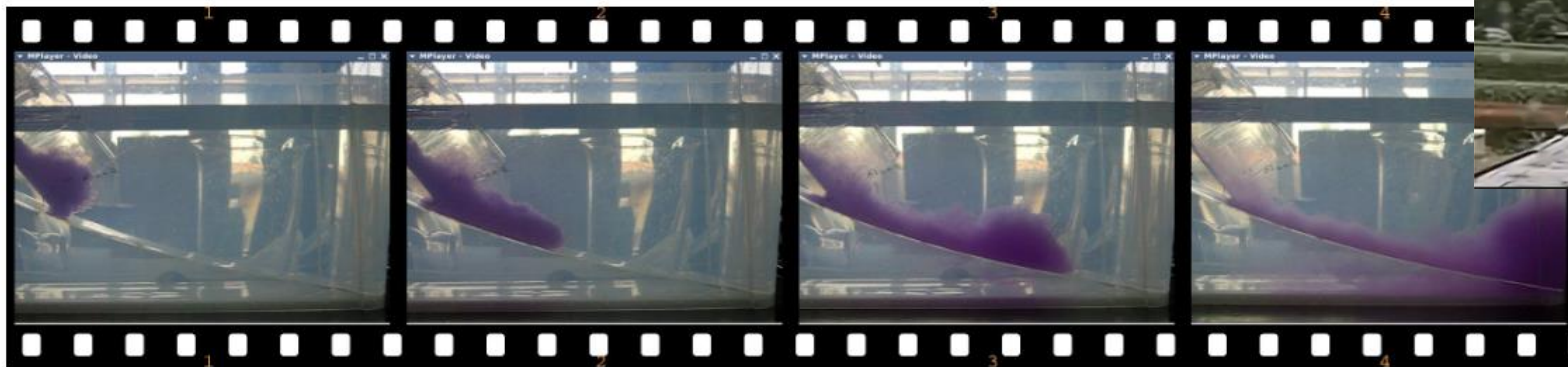


Fig11. A coloured sugar water flow mimics a Pyroclastic flow.

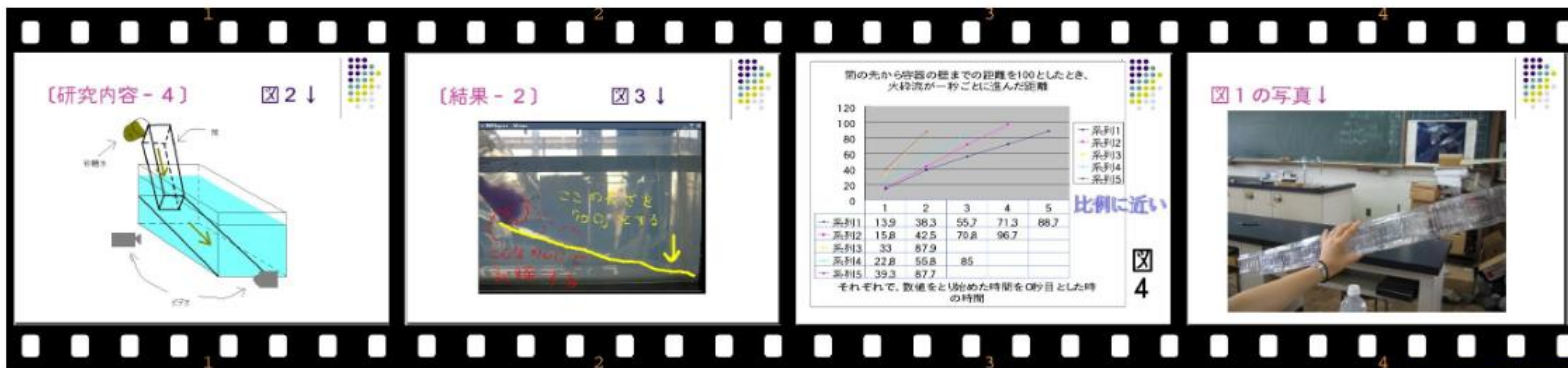


Fig12. An analysis about "Sugar water pyroclastic flow".

Example_7 *Liquidization and sand_dune*



Fig13. Mixture of plastic balls with vibrate-motor mimic ground liquidizing.



Fig14. A sand dune model using polyethylenes balls.



detail/pickup012.html

Example_9 'Air mirage' is examined---

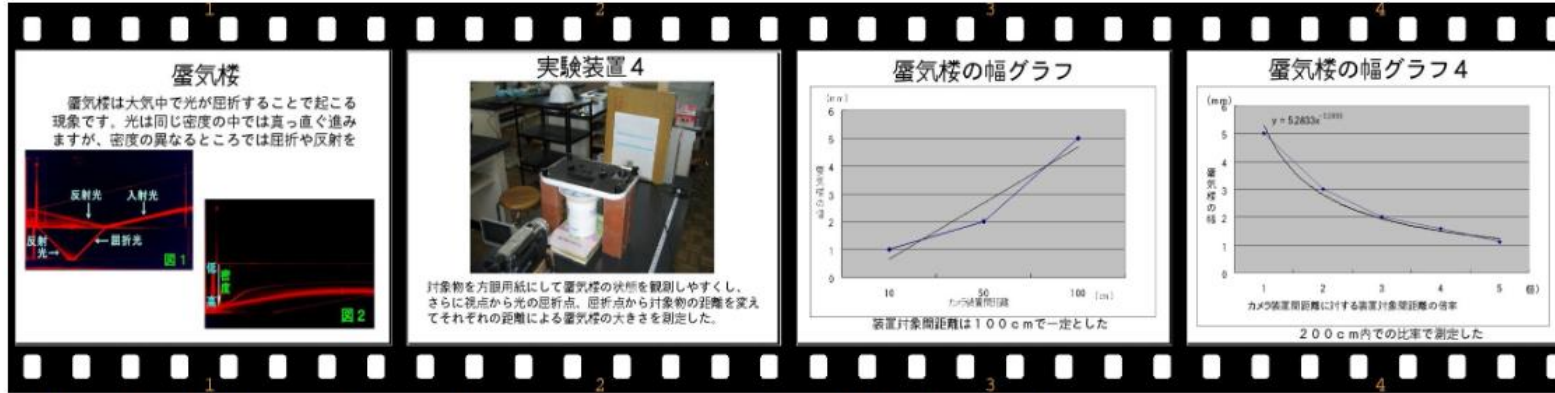


Fig17. 'Air mirage' in a hot and cold chamber .



Fig18. An example showing inverse layer and failed examples.



n/ja/dic-fr/mirage

Example_10 *K/T asteroid impact!!!*

David A. Hardy
www.astroart.org



Fig19. Baby powder in a 'Fish tank' and a Japanese food 'Fu'.



Fig20. Volt-meter shows a depletion of sun ray with an impact.



Example_8 *The 'Japan Island' is sinking---*

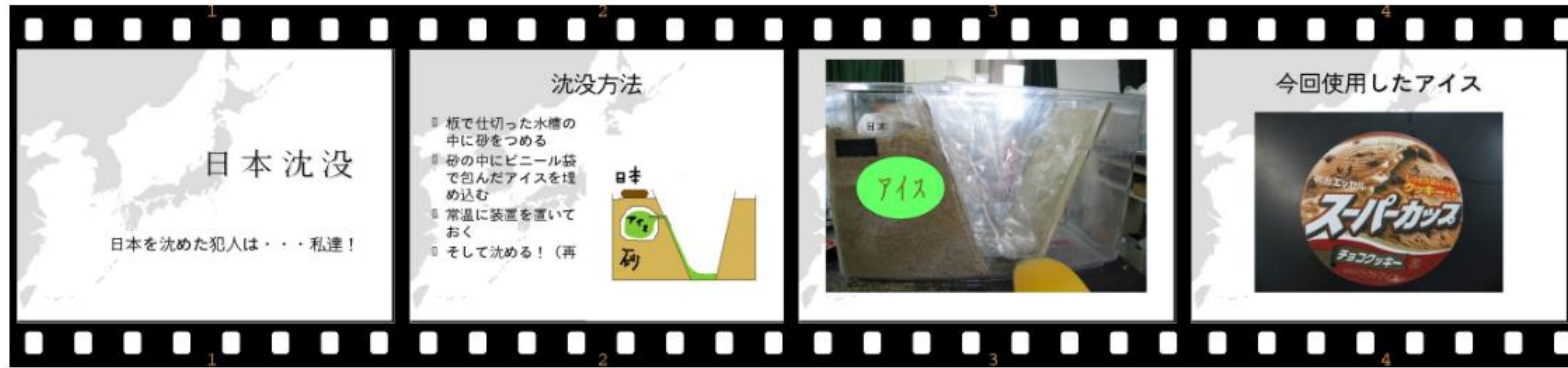


Fig15. 'Japan island' sinks into the pacific plate! After ice cream melting.

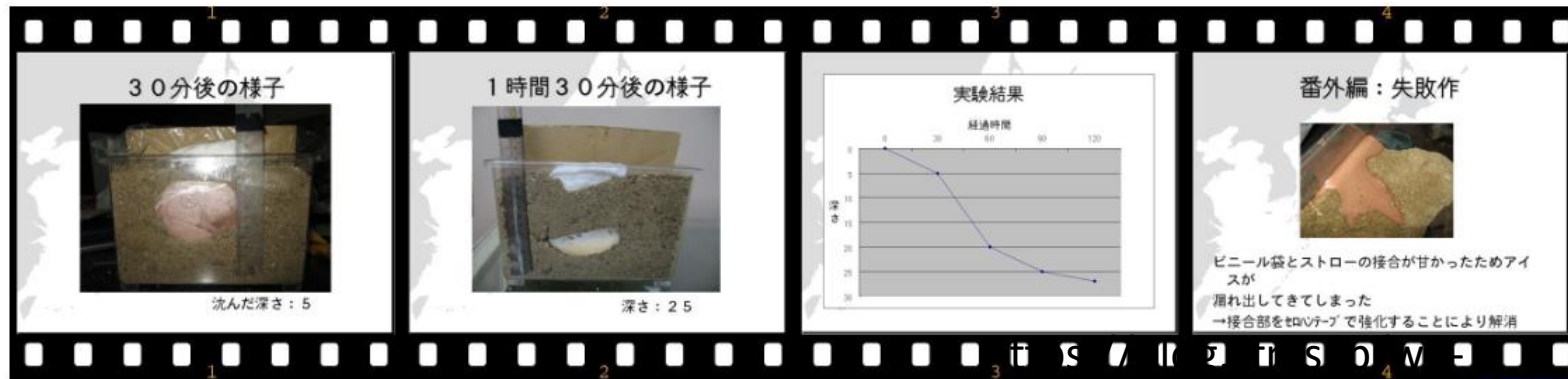


Fig16. Clips, an analysis and a failed example!



Some clips of experiments:



Fig21. Shake the bottle but not stand. And shake---, succeed!



Fig22. Making chocolate fan??? Too sweet!!!!

Let's cook!



Fig23. This is not a kitchen but a earth science laboratory.



Fig24. Various food materials and items for experiments.

We call them Kitchen Earth-science!

I recommend “model experiments” or “Kitchen Earth-science!”

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