

## Development of a Simple Experiment for Understanding the Ramification in the Earth Science

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We carried out a simple experiment to understand ramification that occurs in the Earth science. In the experiment, we sandwiched acrylic paint between two acrylic plates and opened the two plates. When we were opening the two plates, air flows into the spaces between the two plates and penetrates into the acrylic paint. Consequently both the paint and passage of the air describe the branched structures. In this study, we quantified the branched structures using fractal analysis and Horton's laws to evaluate the degrees of complexity and the branched patterns. As a result, the branched structures appeared similar to the ramifications in the Earth science. This experiment is an easy yet effective tool to show the process of a ramification to students.

Keywords: ramification, fractal analysis, Horton's law

Let's make Migmatite!

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1.none

White chocolate melts at a lower temperature than dark chocolate. We made "Migmatite" based on the difference in melting temperature between dark and white chocolate.

Ingredients: White chocolate, dark chocolate.

Recipe: Heat the ingredients.

Method of Heating: Bain-marie.

Why we made Migmatite-like chocolate:

We saw Migmatite at Higo metamorphic terrane. We made the Migmatite-like chocolate to learn more about it.

Results:

We succeeded in reproducing the Migmatite structure. We were able to learn more about Migmatite.

Keywords: Migmatite, white chocolate, dark chocolate, melting temperature

Free Fall Experiment of Glass Beads in Inclined Water Tank  
- Group Effect of particles in pyroclastic flow and avalanche -

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Both pyroclastic flow with eruption of a volcano and avalanche at snow-covered mountain are commonly a phenomenon where mixture of particles and fluid fall down at a slope. Purpose of this study is to investigate the group effect of many particles in the mixture. In order to realize the fluid on inclined slope, clear acrylic square pole filled with water is fixed with a pedestal, at arbitrary inclination angle. The side length of square is 10cm, and height of the pole is 50cm. In addition, the pole is marked in each 10cm from the top. In order to realize free fall down of particles group, glass beads with same size are dropped down from the bottom at top of the inclined water tank. Furthermore, in order to investigate group effect of particles, the number of the glass beads was changed from 1 to 2, 3, 4, 5, 6, 10, 20, 30 and 50.

In each experiment, the terminal velocity of the glass beads group is measured. The method of measurement is that

1. A smart phone is set to timer mode.
2. Both free fall of the glass beads and indication of the timer are recorded as a movie, using a digital camera of home appliances.
3. The time when the group of the glass beads pass by the marks on the water tank are read with low speed playing, and the data is converted to velocity data.

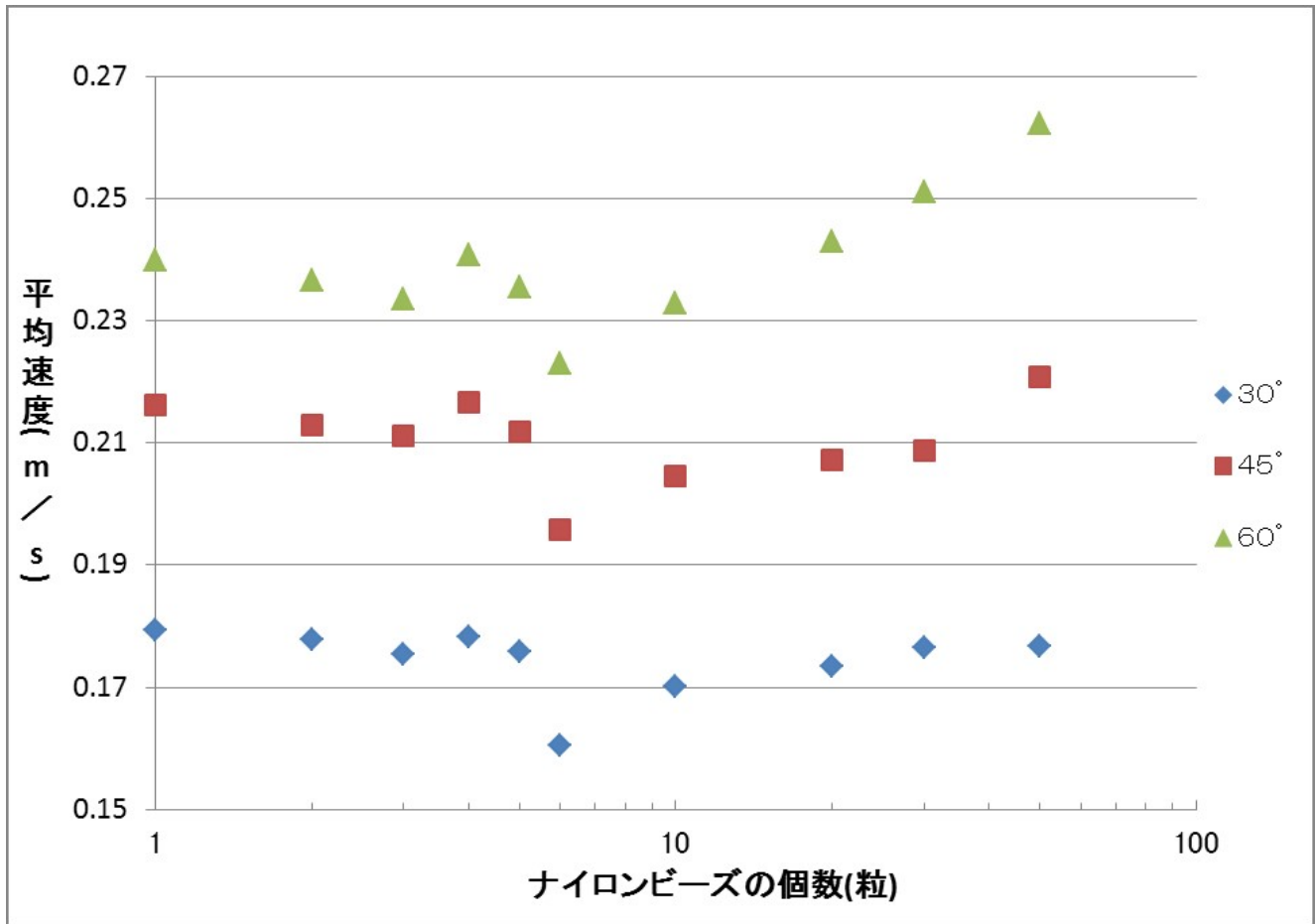
In the range from one particle experiment to 5 particles experiment, each bead fall down in almost same speed. In the six or more particles experiment, the particles group broke apart in lengthways. The ranking of each bead is changing each other. However, both the head bead and the end bead are always recognized. As a result of velocity measurement of the head bead and the end bead in each time, it was found that each velocity is almost same, after passage time through the first mark. Therefore, total average of the top bead velocity and the end bead velocity in each passage time is regarded as the terminal velocity of the beads group.

A result of the three kind of experiment series is shown by fig. 1. Not only the larger is inclined angle the larger is the terminal velocity, but also, we can see interesting common features in any inclined angle. That is,

1. In the range that the number of particles is from 1 to 3, the larger is the number of particles the smaller is the terminal velocity of particle group.
2. In the range that the number of particles is from 4 to 6, after ones jumping of the speed, the larger is the number of particles the smaller is the terminal velocity of particle group again.
3. In the range that the number of particles is from 6 to 50, the larger is the number of particles the larger is the terminal velocity of particle group on the contrary.

It is implied that the effect of group of particles is able to categorized into three kind systems. About the fall down of the mixture of particles group and fluid, a simple model was supposed. a interpretation against changing tendency of the terminal velocity was tried.

Keywords: pyroclastic flow, avalanche, Laboratory Experiment



## Making Instruments and Simple Observation of Infrared, visiblelight, Ultra Violet.

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In recent years, along with the remarkable progress of small information terminals such as cellular phones, various sensors have come to be provided at low cost miniaturized.

In addition, to improve the degree of integration, even introductory of making electronic tools has been difficult , the hurdle has fallen by developpment of one-chip microcomputer. And they are, in the recent progress in the development of environment it is possible to draw on advanced observation equipment in the degree of difficulty of about plastic model.

This is one of the microcomputer boards that are most popular, in Arduino, using some of the sensor kit, so went the simple observation of as extra goal of student experiment, to introduce it.

Use the microcomputer board Arduino UNO,with Adafruit of Ultra Violet sensor, Color sensors, and infrared sensor using the MLX90614.

As a result of these observations

1)Ultraviolet rays, that air and greatly attenuated by clouds, reflection by the ground and buildings is relatively large of our image.

2)And Using the visible light observation, it is likely possible to mesure cloud cover by utilizing the difference in color of the blue sky.

3)In the infrared, it is known being able to observe the height of cloud bottom. This time we observe in bluesky, it has been found the possiblity to observe the aerosol.

Keywords: Observation, meteorology

## Texture of "Pele's hair": analogy of cotton candy formation

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One will find glass fibers called "Pele's hair" in the volcanic products in Hawaii Islands. It is named after Pele, who is the Hawaiian goddess of volcanos. The texture of the glass fibers (thickness and length of fibers) depends on rheological properties, cooling rate, ejection speed, wind velocity, and so on. In order to understand the formation process of "Pele's hair", we investigated the dynamics of cotton candy formation. The experimental equipment consists of a rotating dish, a heater, and measurement system of temperature and rotation velocity. The rotating dish is made of thin steel, and has small outlets along its periphery. To make threads of cotton candy, the crystal sugar is added to the dish, and rotated at a constant speed. The melted sugar is formed after heating the rotating disk, and is ejected through the outlets. We varied experimental parameters: the rotating speed, heating temperature, diameter of the outlets, which cause a variation in the texture of the cotton candy. We will demonstrate how those parameters affect the thickness of the ejected cotton candy threads and discuss the formation process of "Pele's hair".

Keywords: Volcano, Experiment, viscous fluid