Special classes related to volcanic disaster prevention of Mt. Hakusan ~ Work at Shiramine primary school

*Tsuyoshi Hibino[1], Yoshihiro Hiramatsu[2], Atsushi Sakayori[2], Tatsuto Aoki[2]

1. Hakusan Tedorigawa Geopark Promotion Council, 2. Kanazawa University

After the eruption of Mt. Ontake in 2014, the interest to the volcanic disaster prevention has been increasing. In order to promote the volcanic disaster prevention from a long-term perspective, it is insufficient to stress only the dangers of volcanic eruption and its countermeasures. At the same time, it is necessary to foster human resources who have scientific understanding and interest in volcanoes.
In the Hakusan Tetorigawa Geopark, we carried out four lessons on the volcanic science and the disaster prevention and one field learning with the cooperation of Shiramine elementary school (33 children in all schools) from May to August 2016. In the classes, through lectures and experiments, they learned the composition of Mt. Hakusan, the characteristics of volcanic activity, the system of the eruption, the reaching range of cinder, pyroclastic flow, volcanic mud flow of the snow melting type at the Hakusan volcano disaster prevention plan and the disaster prevention behavior. On the field learning, they observed the rocks of river beach and the traces of lava flow along the ridge, and we looked back at the structure of Mt. Hakusan and the past volcanic activity that they learned in the classes. In addition, by observing the site of sabo construction and meteorological observation facilities through cooperation of the Ministry of Land, Infrastructure, Transport and Tourism and the Japan Meteorological Agency, we deepened the understanding of the local response to volcanic disasters and the mechanism by which disaster prevention information is issued.
In learning natural disasters, not only emphasizing disaster but also understanding the scientific process of phenomenon and learning about that blessing together are helpful to promote correct understanding and it is also a feature of geopark.
In addition, as a result of questionnaire on the volcano learning to parents at elementary school presentation, it turned out that about 60% of families were talking about learning contents. It was also confirmed that classes at elementary school lead to spreading effects not only for children but also for parents.
In this presentation we report the above efforts.

Keywords: Volcanic disaster prevention, Volcano experiment, Education, Field work, Geopark

River investigation system operated by citizens in Muroto Geopark

*Yugo Nakamura[1]

1. Muroto Geopark Promotion Committee

Local people in Muroto UNESCO Global Geopark, southwestern Japan, are worried about environmental changes of the forest in the drainage areas as this may cause changes in the quality of the water, increase the risk of overbank flooding, erosion of river channel, and landform change of beach areas. Our project has established an investigation system for the river and forest environment operated by local people with geopark staffs. This investigation system includes a method of estimating the volume of suspended sediment in river water by simple and easy techniques, such as differentiation of river water colour or transparency. 80% of Muroto Geopark area is covered by forest which is characterized by evergreen broad−leaved trees (mainly Castanopsis and Quercus). Agricultural lands on riverside plain had been urbanized after 1970s, but the condition of the forest has been kept favorable in Muroto Geopark area. Forest industries including charcoal makers in Muroto efficiently manage forest environment. The forest environment keeps moderate sediment amount and gentle river behaviors in Muroto in comparison with drainage basins in the adjacent regions. On the other hand, decrease of river sediment caused reduction of beach deposits and regression of the coast line. Our research project on river and forest environment will be continued next years.

Keywords: River water quality, River sediment, Forest environment, Simple technique

Itoigawa Geopark survey and disaster readiness education in response to the 2016 Niigata Yakeyama Eruption undertaken through strengthened cooperation with the Niigata Yakeyama Volcanic Disaster Council

*Ko Takenouchi[1], Takahiko Ogawara[1], Yousuke Ibaraki[1], Hiroshi Miyajima[1]

1. Fossa Magna Museum, Itoigawa City

Mt. Yakeyama (2400 m), located on the border of the cities of Myoko and Itoigawa in Niigata Prefecture, is the Fossa Magna's northernmost active volcano and is a subject of regular monitoring by the Japan Meteorological Agency. Disaster readiness with regard to Mt. Yakeyama is a major issue for the City of Itoigawa. Since becoming a Global Geopark in 2009, natural disaster-related disaster readiness and disaster education activities have been given great importance. The city government, fire department and Fossa Magna Museum (Part of the Itoigawa City Board of Education, hereafter 'the Museum') aim to act as an agency for disaster readiness, providing scientific information and disaster drills through cooperation with volunteer disaster organizations. The eruption in spring 2016 became an opportunity to test the Itoigawa Geopark's volcanic disaster readiness. In addition to lectures, exhibitions, interpretations, field excursions, river cloudiness inspections and eruption record preservation, efforts were made to support the activities with the Friends of the Museum Society through cooperation with the local Kamihayakawa and Shimohayakawa Regional Community Centers. Also, support was received from the Niigata Yakeyama Volcano Disaster Readiness Council (Hereafter 'the Council') organizational members (Since 2016 curators of the Museum have also served as Council members).
Lectures (2 performed): (1) Current State of Niigata Yakeyama & Examples of Responses to Other Eruptions, Jun Funazazki (Niigata Regional Meteorological Observatory Director), Niigata Yakeyama Disaster Readiness Response, Itoigawa City Fire Department Disaster Readiness Division Chief. Held at the Shimohayakawa Regional Community Center (October 8th) with 140 in attendance. (2) Prediction of Eruptions and Their Mechanisms -Considering Niigata Yakeyama's Future- Kazuhiro Ishikawa (Chairman, Volcano Disaster Readiness Promotion Organization & Kyoto University Professor Emeritus) Understanding Eruption Damage by Reading Volcano Disaster Readiness Maps, Hideyuki Ito (Iwate University Professor), Held at the Museum, October 23 with 83 in attendance.
Field Study of Volcanic Ejecta: This tour was held on November 20 for people living in the Kamihayakawa Region beneath Mt. Yakeyama so they could better understand the scale of eruptions, the size and length of lava and pyroclastic flows, and how the valleys had been filled with volcanic ash, along with a tour of the erosion control dams. The tour was supported by the Friends of the Museum Society and led by museum curators with 34 in attendance.
Special Exhibit 'Preparing for Niigata Yakeyama's Eruptions - Study Volcanos to Save Your Life': Held Oct 23 to Dec 4 at the Museum, this exhibit featured photographs of Mt. Yakeyama, locally sourced materials about volcanic disasters, map data of Yakeyama's caldera provided by the Geospatial Information Authority of Japan, as well as panels on loan from the the Science Museum of Map and Survey and the National Volcanic Museum Federation Council.
Gallery Talk (Exhibition Interpretation): 8 interactive discussions led by museum curators were held on Sundays and holidays featuring demonstrations of pyroclastic and lava flow and inspection of volcanic ash and lava. 70 were in attendance.
River Cloudiness Inspection: Niigata Prefecture and Itoigawa City (Including the Fire Department and the Museum) conducted two analyses of the water quality and source of cloudiness which determined that

the source was from a hot water spring located at an elevation of 1050 m. These findings were reported to local people at a special lecture.
Eruption record preservation: A physical record of the debris, debris flow and mudslide damage caused by the 1974 phreatic eruption handwritten by local resident Hirokichi Hara was discovered and digitized to ensure its preservation.
Through partnership between the Council and the Itoigawa Geopark, the following positive outcomes have been achieved: (1) Support has been received from various experts and research organizations for the disaster readiness activities of Mt. Yakeyama (2) We have not only received volcanic observation data, but also been able to share our own surveys performed by the Itoigawa Geopark (3) We have been able to request a strengthening of the scientifically based observation system as the Itoigawa Geopark.

Keywords: Niigata Yakeyama Volcano, Steam eruption, Itoigawa UNESCO Global Geopark, Museum

Seismological application in activity at Geopark

*Makoto MATSUBARA[1], Kazuyuki Nakagawa[2], Yoshihiro Hiramatsu[3]

1. National Research Institute for Earth Science and Disaster Resilience, 2. Jiji Press, 3. Faculty of Natural System, Institute of Science and Engineering, Kanazawa University

1. Introduction
Geoparks are single, unified geographical areas where sites and landscapes of international geological significance are managed with a holistic concept of protection, education and sustainable development. There are also many both natural and cultural heritages of earthquakes. The Seismological Society of Japan (SSJ) should supply appropriate contents for Geoparks as well as wait for the Geoparks to ask us to assist as the support for Geoparks. The SSJ established the working group of the preparation for Geopark support committee.

2. Questionnaire survey for Geoparks
In September, 2016, the working group conducted the questionnaire survey for 57 regions composing the Japan Geopark Network, which are the UNESCO Geoparks, the Japan Geoparks, and associate members for proceeding to be Japan Geoparks. We supplied the information on seismic stations operated by National Research Institute for Earth Science and Disaster Resilience (NIED) within the Geoparks with the questionnaire. The reply came back from 47 regions.

3. Result
The earth formed by earthquakes and crustal deformations is applied to guide in the over 80 % of the Geoparks. About 65 % of the Geoparks have seismic geocites, however, the others do not have. There is no seismic geocites in about a quarter of the about 35 % of Geoparks, however, the others do not know whether they have the seismic geocites or not. Historical earthquake and tsunami marks, surface ruptures of the active faults are used as the geocites. Active faults as the geocites are not limited in the 102 active faults evaluated by the Headquarters for Earthquake Research Promotion of the Ministry of Education, Culture, Sports, Science, and Technology in Japan, however, many Geoparks do not use the them in the guide despite those within the Geoparks.
There are over 3000 seismic stations in Japanese Islands operated by NIED, the Japan Meteorological Agency, national universities, and so on. About 60 % of Geoparks recognize the existence of the seismic stations within the Geopark, however, only 20 % of them use the seismic stations as geocites.
A half of the Geoparks hold seminars about the earthquakes. These seismologically educational activities are usually held regardless of a large earthquake since many of them are held before the 2016 Kumamoto earthquake.

4. Discussion
Geoparks with seismic geocites hope the SSJ to hold seminars about attractive geostories connecting seismic stations and the Geoparks, however, they hope us to do gratis or with low rates because of the tight budget. The SSJ needs to supply a tool to get easily the seismic information within the Geopark and construct the organization to respond to the request from the Geoparks.
Geopark with no seismic geocite hesitate to get support from SSJ since they cannot image the relationship with the SSJ. They hope to have relationship with us after the recognition of the obvious seismic geocites or active faults. However, the inland earthquakes also occur at the blind faults in any time anywhere in Japan. We need to hold seminars or give lectures at the Geoparks with no geocite nor earthquake record

just after the disastrous earthquakes.

Keywords: geopark, seusmoligy, seismic station

Revision of the stratigraphic division of the Neogene in the Sado Island, Niigata Prefecture, Central Japan -Contribution of stratigraphic research to geopark activity-

Yukio Yanagisawa[1], *Mahito Watanabe[1]

1. Institute of Geology and Geoinformation, National Institute of Advanced Industrial Science and Technology

Latest Paleogene to Neogene volcanic, volcanoclastic and sedimentary rocks are widely distributed in the Sado Island, central Japan. These rocks are important geoheritages which represent geological history of the Japan Sea. The Sado Geopark utilizes those rocks along with the geohistory recorded in them as major attraction for visitors.
We propose a revised lithostratigraphy for the Neogene sediments in the Sado Island in order to make it more concordant to the geohistory in the area, since our detailed lithostaratigraphic and diatom biostratigraphic studies have revealed some problems about stratigraphy in this area as follows;
1. One of the present stratigraphic boundaries is largely diachronous.
2. Some of the boundaries do not coincide to the timing of the important geological events which was made clear after the establishment of present stratigraphic framework.
Our proposal is;
The Orito Formation is devided into two formations. The boundary between two formations is ravinement surface indicating a rapid transgression, which corresponds to the transgression event widely found in latest Early Miocene along the eastern margin of the Japan Sea.
The Tsurushi Formation is disestablished and included in the redefined Nakayama Formation. The boundary between the two formations is revealed significantly diachronous by our diatom biostratigraphic study. The lithological difference between the two formations was formed by the diagenetic process and is not primary lithological difference. Thus we judged the present boundary is not adequate and the two formations must be combined.
The Nakayama Formation should be divided into two formations at a glauconite sandstone layer in upper part of the formation. The boundary between the two formations corresponds to a widespread hiatus which has been recognized in eastern margin of the Niigata sedimentary Basin.
By this revision, geological events widely found in the eastern margin of the Japan Sea are reasonably recognized in the Neogene stratigraphy of the Sado Island. We believe that this revised stratigraphy helps visitors of the Sado Geopark understand geological history of the island more easily.
In other geopark areas, there are also descrepancies between up-to-date geological history and lithostratigraphy. In general, researchers are not interested in local stratigraphy of geopark areas, and therefore such discrepancies are left unresolved. Cooperation between geologists in such geoparks and researchers in universities or institutes will resolve these problems by establishing a reasonable new stratigraphic framework.

Keywords: Neogene, Stratigraphic division, Diatom biostratigraphy, Geopark, Sado Island

Damage investigation activities utilizing Geopark organization for the 2016 Itoigawa Station North Great Fire in Itoigawa City, Niigata Prefecture

*Takahiko Ogawara[1], Ko Takenouchi[1], Hiroshi Miyajima[1], Yousuke Ibaraki[1], Toshihiro Uchiyama[2], Goichi Yamamoto[3], Takeshi Kubo[4]

1. Fossa Magna Museum, 2. Itoigawa Geopark Promotion Office, 3. Itoigawa Geopark Tourism Guide association, 4. Friends of Fossa Magna Museum

On December 22, 2016 at about 10:20 a.m., a fire broke out in a ramen restaurant near the north entrance to Itoigawa Station. Southerly winds caused the fire to quickly spread, becoming the largest fire in Itoigawa City since 1954. It has been given the name “2016 Itoigawa Station North Great Fire” (provisional). Over 43 teams of firefighters were dispatched to the fire from Itoigawa and neighboring towns, but the gale force winds allowed the flames to leap from building to building, complicating the containment efforts.

The fire was safely contained at 8:50 p.m. and after continued firefighting efforts it was finally extinguished the following day at 4:30 p.m. 17 people suffered minor to moderate injuries, but in part due to police and the residents’ efforts, there were no casualties. 147 buildings were damaged in the fire (120 completely destroyed, 5 half destroyed and 22 partially damaged), including Kaga-no-I, Niigata Prefecture’s oldest sake brewery established in 1650; 200 year old restaurant Tsurukiya; and the similarly old inn Heiando Ryokan. Roughly 40,000 square meters were consumed in the fire, making it the worst fire in Japan in the past 20 years (Fig. 1).

In 2009, Itoigawa City became one of Japan’s first three Global Geoparks. Even before that time, the city worked to promote the “geostories” which connect the regions’ unique climate, topography and geology. For this reason, the city was able to quickly explain that this fire’s devastating spread was a result of this *Renge-oroshi* wind phenomenon, a product of regional geological features such as the Umidani Mountains, Northern Alps and valleys created by the Itoigawa-Shizuoka Tectonic Line. This fire is the first in Japan to be classified as a natural disaster as defined by the Act on Support for Reconstructing Livelihoods of Disaster Victims due to the effect of strong wind. The government’s decision to classify this fire as a natural disaster is in no small part due to the efforts of the Geopark in making a clear case to the administration that this fire spread as a result of this *Renge-oroshi* phenomenon and how this phenomenon is related to Itoigawa unique topography, geology and climate.

The investigation of the fire damage was undertaken by the existing Geopark Organization. The defining feature of this fire is how it spread through leaping flames carried by gale force winds recorded at speeds up 27.2 m/s. As the flames leapt from building to building, the sources of the fire increased and by noon over 3 distinct fires were confirmed. Because of this, it is important that the damage investigation includes a detailed investigation of when and where the fire spread, especially with regard to leaping flames. In interviews with responders from the Itoigawa City Fire Department, most of the fires caused by leaping flames broke out far from the original fire where no firefighters were responding so the details are unclear. For this reason, it is important to collect information through interviews with the residents, business owners and banks in and around the affected area.

This damage investigation will be conducted with the help of volunteers from the Itoigawa Geopark Tourist Guide Association and the Friends of the Fossa Magna Museum Society, both member organizations in the Itoigawa Geopark Council. The reason for choosing these volunteers was the need for people who could interview the many people affected in and around the disaster site from a scientific perspective. The investigation was conducted from the beginning of February 2017 with volunteers conducting face-to-face interviews with those affected by the fire and collecting anonymous surveys regarding the spread of the fire and the conditions at the disaster site. This data was then compiled and analyzed at the Fossa Magna Museum (Fig. 2).

Through this data, a clear image emerged of how the fire spread through leaping flames on the day of the fire. Hours after the fire broke out, the flames leapt to a building a few hundred meters from the original fire and the strong winds made extinguishing the flames difficult. We also learned that windows broken by the fire causing the fire to leap into the buildings where the flammable interiors quickly burst into flame. Also, burning wood falling in between cracks in roof tiles caused the roofs to catch fire.

Through further consideration of the results of this investigation, we hope to better understand the conditions surrounding the spread of this fire. The information gathered from the investigation will be shared throughout the Geopark Network in the hope that it will be useful for disaster prevention.

Keywords: Itoigawa city, Massive fire, Foehn phenomena, Damage investigation, Natural disaster, Itoigawa UNESCO Global Geopark

Fig.1

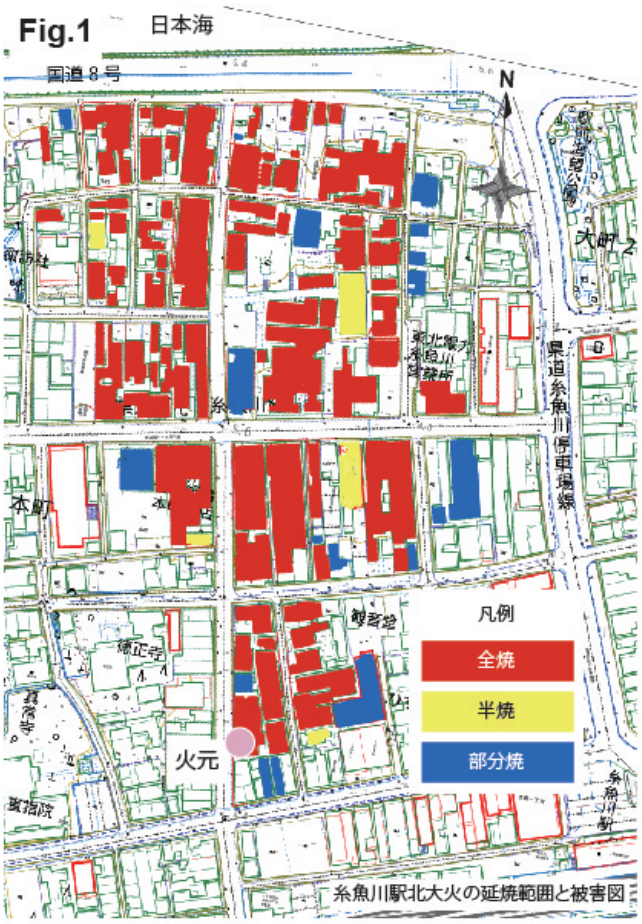


Fig.2

Seamless geostory including atmospheric and hydrologic sciences: A case of Daito Islands, Japan

*Shunsuke Tsushima[1], Takayuki Ogata[2]

1. Mito Local Meteorological Office, 2. Disaster Prevention Research Center for Island Regions, University of the Ryukyus

Seamless geostory and a geoscientific guidebook is developed in Daito Islands (located in Okinawa prefecture), focusing especially on contents of atmospheric and hydrologic sciences. Climate in Daito Islands is strongly controlled by Pacific anticyclone and uplifted atoll forms on Philippine Sea Plate. Landform of Daito Islands shows shallow depression covered by Quaternary coral limestone, which produces specific meteorological and climatological phenomena such as inactive ascending current and cold air pool by strong surface inversion. These atmospheric and hydrologic topics are linked with historical geology in a seamless geostory and a guidebook for geoscientific outreach. In addition, our guidebook includes JMA Minamidaitojima Meteorological Office for interpretation of upper air analysis as an advanced scientific research.

Keywords: Geostory, Atmospheric Science, Hydrologic Science, Daito Islands

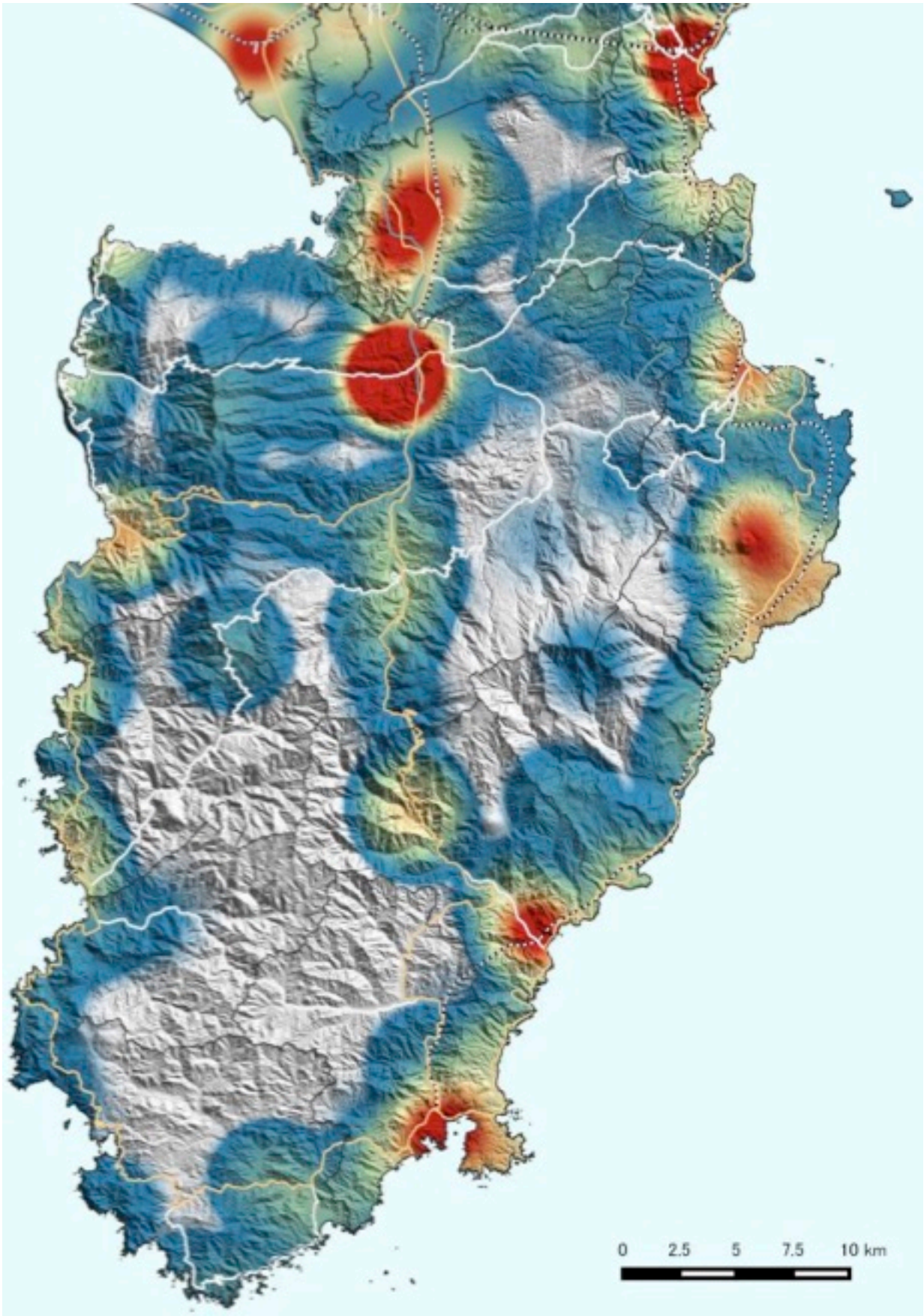
Geopark visitor's trend survey using distribution of location-added photograph posted on SNS

*Yusuke Suzuki[1]

1. Izu Peninsula Geopark Promotion Concil

In this research, we attempted to grasp the tendency of visitors from the distribution of photos with location posted on SNS within the Izu Peninsula Geopark area.Flickr with a high proportion of photographs taken with single lens reflex etc was used as the source of photographs.In 2015 there were 5000 photos taken in the Izu peninsula. Using the latitude and longitude information contained in the list of this photograph, the photographing spot was plotted on the GIS.In this presentation, we will report on the location of the visitor ascertained from the photo shoot location, and the relationship between the trend and geosite.

Keywords: Geopark, SNS



Present State of Geoparks on the Twitter. -Prospectuve study based on Social Network Analysis-

*Hideyuki Itoh[1], Hanako Onodera[1], makoto kumagai[1,2], Morio Tsuji[1], Masaki Suzuki[1]

1. Faculty of policy studies, Iwate prefectural University, 2. Sanriku Geopark commitie

As of January 2017, there were 43 geoparks in Japan, of which 8 are designated as UNESCO global geoparks. Various activities are conducted in these geoparks, such as those for ecotourism and product development. However, in many geoparks, these activities did not contribute to sustained regional development.
Itoh *et al.* (2015) used an Internet questionnaire to investigate the level of awareness of geoparks, finding that people’s awareness of geoparks is generally low and they also do net have a difinitive image of Geoparks.
Recently, an information marketing business that analyzes big data on social networking sites (SNS) such as Twitter and LINE was developed. It used in various fields to investigated such as corporate image and risk management of the corporate.
In this study, we investigated the word of “Geopark” is how tweeted and shared on SNS using the big data analysis provided by Valway121 net Ltd.
Over the three-week measurement period from December 7 to 21, 2016, 20,000 cases per day were analyzed. In addition to “GeoPark,” “ecopark” and “world heritage site” were included in the search conditions, and the results were compared.
During the measurement period, the number of hits for geopark was 1,049, while those for ecopark and world heritage site were 63 and 2,753 respectively, indicating a significantly higher number of hits for the latter. Furthermore, the number of hits for geopark rose to 172 on December 9, 2016, which was attributed to the announcement by the Japan Geopark Committee (JBC) of the recertification examination results on the same day.
Most geopark influencers are geopark stakeholders such as “izugeo.” In contrast, many individual world heritage enthusiasts, travel lovers, and bot systems rank highly for world heritage. Furthermore, the number of followers of these Twitter accounts is more than 10 times that of the geopark stakeholders, and a tendency to transmit the same information repeatedly was recognized.
On the other hand, in terms of the characteristics of comments on geoparks, geopark stakeholders mostly describe events and geosites, and the number of retweets was not that high. In addition, the number of comments by people other than the stakeholders was extremely small. In other words, on SNS, geoparks are considered to form a closed system comprising their stakeholders and a few geopark enthusiasts.

Keywords: Geopark, twitter, SNS analysis, ecopark, World Herritage

Characteristics of geopark evaluation system as seen from the field evaluation reports by the Japan Geopark Committee

*Masahito Yamada[1,2], Shinichi Sugimoto[3]

1. Board of Education, Choshi City Hall, 2. Choshi Geopark Promotion Council, 3. Sanriku Geopark Promotion Council

1. Introduction

The concept of Geopark arose in the mid-1990s as a response to conserve and enhance value of areas of geological significance in Earth history. Later in 2004, with the support of UNESCO, European Geoparks and China Geoparks came together to create the Global Geoparks Network (GGN). In Japan, the Japan Geopark Committee (JGC) was established as a domestic judging organization in 2008. The JGC conducts evaluation to join Japanese Geoparks Network (JGN), assessment of activities at geoparks belong to JGN, evaluation of candidates for new accession belong to the GGN. Domestically, seven regions were first certified as Japan Geopark in December 2008, and now there are 43 geoparks (of which eight regions are from UNESCO global geopark).

The JGC has undergone evaluation of domestic geoparks over nine years, and the results have been published on the web. In this research, we analyzed what are the features we can see in JGC evaluation reports.

2. Method

We conducted text mining using results from 2009 to 2016 at each geopark from the JGC's evaluation reports. We used KH Coder, a free software.

We arranged the evaluation reports as follows. First of all, as a first stage, it was divided into three categories: JGN new evaluation, JGN revalidation, and GGN candidate. As a second stage, we classified them among the categories according to the year in which the evaluation was conducted. As the third stage, we classified it by region for each year.

We examined whether there are distinctive words in each of the three categories of the first stage. Also, we examined whether there were characteristic words transition along the timeline. We also examined the co-occurrence relation of the characteristic words.

3. Result

JGN new evaluation, JGN revalidation, GGN candidate appears distinctive words, respectively. Also, characteristic words were found to have changed along the timeline.

Keywords: Japan Geopark Committee, field evaluation reports, text mining

Definition of geosite and operation in Japan

*Kuniyasu Mokudai[1]

1. Japan Geoservice Incorporated

Geopark consists of geosites. In geopark activities in Japan, geosites have been described as "natural and cultural attractions on earth science", and thus precise definitions have not been made. There is no mistake in the meaning of geotourism, but it is a place with scientific value, which is the original purpose, and it is missing the meaning that it is subject to conservation. Since 2015, the Global geopark has become an official UNESCO programme, and social recognition has also improved. Under such circumstances, the situation that individual Geoparks designate geosites based on their own recognition must be revised. I will organize geosites of each geopark in Japan from conservation geoscientific point of view. Then deepen the discussion on the definition of geosite.

Keywords: geosite, conservation earth science, definition of terms

Let us Enjoy Geo-Tetsu - the Seventh Geo-tour through Train Windows, Minami-Rias Line of the SANRIKU RAILWAY

*Masayo Fujita[1], Shoji Ueno[1], Keisuke Imao[1], Shunji Yokoyama[1], Hironori Kato[1], Tadashi Yasuda[1]

1. Geo-Tetsu project committee of the Fukada Geological Institute

1. Aims of Geo-Tetsu activities

Geo-Tetsu is the name of the activity that shows people enjoy and learn about geology related sciences, using railways (Kato et al., 2009). Following nine years Geo-Tetsu promote activities are continued by geological engineers who love railways, organized with the corporation of the Fukada geological institute since 2009 (Fujita et al., 2013) and established Geo-Tetsu Project Committee since 2013 (http://fgi.or.jp/geo-tetsu). Geo-Tetsu offers the chance to get acquainted with geological features alongside the railway routes. We selected enjoyable Geo-Tetsu courses and Geo-points.; the railway itself, geology, geography, cultural heritage and sight-seeing as well. We hope that the general public will enjoy a new style of railway traveling provided by the Geo-Tetsu. The Minami-Rias Line is presented in this as seventh route of Geo-tetsu, based on Sanriku Railway Geo-Tetsu Map, 2017.

2. The Minami-Rias Line, the seventh Geo-Tetsu project

(1) Abstract of the Minami-Rias Line

The Minami-Rias Line runs from Ofunato City to Kamaishi City on the Sanriku Coast on the most easterly region of Iwate Prefecture on Honshu. The railway connects from Sakari Sta. to Kamaishi Sta.at 36.6km. It is single track and the route is non-electrification. The Sanriku Railway's original railcar 36type (the white body with red and blue lines) and the luxurious passenger railcar with unique events are operated throughout the year.

Sanriku Railway was built to resist tsunami because this area has suffered tremendous damage from natural disasters in the past several times. It started to constructed as a high-standard trunk line by Japanese National Railway (JNR) in the 1960s. Following the decision to close JNR's Sakari, Miyako and Kuji Lines, Sanriku Railway opened in April 1984 as a third-sector railway company in Iwate Prefecture, local governments and private companies to maintain local rail services. In the 11 March 2011, the company suffered serious damage by Great East Japan Earthquake and Tsunami. The service was fully resumed on April 2014. It is continued by Sanriku Railway Company themselves that the plans of Disaster Area Front Line Training and Earthquake disaster learning train as disaster tourism.

(2) The rich geological and sight-seeing resources of the Minami-Rias Line

The Minami-Rias Line runs eastern region in Kitakami Mountains that consist of the Cretaceous volcanic rocks and granitoids in the North Kitakami Belt, and a partly area (Sakari Sta.- Rikuzen Akasaki Sta.) of the Perminan in the South Kitakami Belt. Geographical feature of this line is in the rias coast. Therefore the train necessarily goes to high-standard tunnels through the steep mountains foot of the peninsulas. Seven bays appear in sequence in the train window. The train leaves at Sakari Sta., goes to Sakarigawa bridge and crosses above the Iwate Development Railway line. From Rikuzen-Akasaki Sta. to Ryori Sta, the Jomon culture flourished. The train stops once at Koishihama Sta. (asl 43.6m, the highest in this line), there are a lot of ema pictures depicting scallops with wishes. From Koishihama Sta. to Sanriku Sta., it was repaired as concrete structure embankment. It is still originally rip rap masonry at north side of Sanriku Staion. Yoshihama area has been known as Miracle Village because villagers were saved by learning from Tsunami experience and following the teachings of their predecessors. We recommend a visit of the Tsunami Rock of Showa era 1933 at Yoshihama coast. At Toni Sta., there is a monument of a geographical

survey of Ino Tadataka made in the late Edo era, walking through the famous cherry blossoms street of Hongo district. At Heita Sta., it is near the Iron and Steel History Museum and the Kamaishi Daikannon (48.5m high) of symbol of Kamaishi area. Lastly, the train crossing two Owatari-gawa bridges, the train arrives at the Kamaishi Station. There you can touch the origin of modern Japanese iron industry.

Keywords: Geo-Tetsu, Sanriku Railway, Minami-Rias Line, Geo Point, Rias Coast, Sanriku Railway Geo-Tetsu Map

Let us Enjoy Geo-Tetsu - the Eighth Geo-tour through Train Windows, Kita-Rias Line of the SANRIKU RAILWAY

*Masayo Fujita[1], Keisuke Imao[1], Shoji Ueno[1], Shunji Yokoyama[1], Hironori Kato[1], Tadashi Yasuda[1]

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2. The Kita-Rias Line, the eighth Geo-Tetsu project

(1) Abstract of the Kita-Rias Line

The Kita-Rias Line runs from Miyako City to Kuji City on the Sanriku Coast on the most easterly region of Iwate Prefecture on Honshu. The railway connects from Miyako Sta. to Kuji Sta.at 71.0km. It is single track and the route is non-electrification. The Sanriku Railway's original railcar 36type (the white body with red and blue lines) and the luxurious passenger railcar with unique events are operated throughout the year. Sanriku Railway was built to resist tsunami because this area has suffered tremendous damage from natural disasters in the past several times. It started to constructed as a high-standard trunk line by Japanese National Railway (JNR) in the 1960s. Following the decision to close JNR's Sakari, Miyako and Kuji Lines, Sanriku Railway opened in April 1984 as a third-sector railway company in Iwate Prefecture, local governments and private companies to maintain local rail services. In the 11 March 2011, the company suffered serious damage by Great East Japan Earthquake and Tsunami. The service was fully resumed on April 2014. It is continued by Sanriku Railway Company themselves that the plans of Disaster Area Front Line Training and Earthquake disaster learning train as disaster tourism.

(2) The rich geological and sight-seeing resources of the Kita-Rias Line

The Kita-Rias Line runs eastern region in Kitakami Mountains that consist of the Cretaceous volcanic rocks and granitoids, Jurassic accretionary complex, and Cretaceous and Paleogene sedimentary rocks in the North Kitakami Belt. Geographical feature of this line is in the marine terrace region. The train goes through long tunnels under the terrace and crosses high−standard bridges at deep valleys.

The train leaves to the inland at Miyako Sta. near the Jodogahama Beach. It goes up and down the incline of 16-20 ‰passing through three stations. Arriving at Taro Sta., the Sanno Rock (Miyako Group) stands at the entrance of the Taro Bay. Sea wall is constructing in past town area. The train advances straight the longest Masaki Tunnel 6532m at the north side of Taro Sta., you can hear it carefully that the change of engine sound up and down inside the long tunnel. Crossing the Omotogawa Bridge, Iwaizumi-Omoto Sta. is role of a disaster prevention center and a sightseeing base to Ryusendo Cave and Moshi area. Between Shimanokoshi Sta. and Tanohata Sta., there are lots of Geo Points that Miyako Group is rich in the fossils, a Tsunami Rock is in the Haipe Coast, and the sightseeing ships to Kitayamazaki Cliff are waiting for you at the ports. Through the Hudai Water Gate, train crosses the Osawa and Akkagawa Bridges with beautiful

view of marine terrace. Passing Noda Tamagawa Mine Remains and Daito no Kura (Noda Group) at Tofugaura Beach, lastly train arrived at Kuji Station. In the north entrance of Sanriku Railway you can touch the interesting Kuji Culture; Kuji Amber, Kuji iron, Kokuji Ware and also the stage areas of the NHK's morning TV drama *Amachan*.

Keywords: Geo-Tetsu, Sanriku Railway, Kita-Rias Line, Geo Point, Marine Terrace, Sanriku Railway Geo-Tetsu Map

A revision of the evaluation method of geosites for geoparks management and promotion

*Dorota Anna Suzuki[1], Hideo Takagi[2]

1. Research Institute for Science and Engineering, Waseda University, 2. Department of Earth Sciences, Faculty of Education and Integrated Arts and Sciences, Waseda University

Geosites are sites of scientific interest based on geology or geomorphology that can serve various purposes, such as future research, conservation, education, tourism or sustainable development of a certain area. During the last two decades many researchers have tried to devise a uniform method to measure specific values of geosites in different ways. This work presents the revision of the evaluation scheme, which was introduced during the 4th Asian Pacific Geopark Network (APGN) Symposium in San' in Global Geopark in 2015. Since that time, we have made some changes to the scoring criteria and drawn new conclusions. The revised model provides more consistent criteria for evaluating sites of various types (e.g. geological, ecological, cultural), and thus could help in planning and management of geotourism development within geoparks. The results are visualized using radar charts, which are designed in a way that is very helpful for understanding the types of values that deserve to be conserved and those that can help sustainable use of a site.

Keywords: geosite, geopark, evaluation, geotourism

A report of trial to sustainable economic development Mt. Kurikoma Area Geopark special food product "Kurikoma Sanroku No Megumi"

*Sato Mitsuru[1], Go Miura[1]

1. Mt. Kurikoma Area Geopark

Mt. Kurikoma Area Geopark began special product certification program "Kurikoma Sanroku No Megumi", 2016.

It has been examined since 2015 as a development project "Geopark products" by Tourism Section, Product development working. Increased need "Special Product" from the area and visitors. By "Japan Geopark" certified , 2014. However, as development progressed, problems on the "reasons of Geopark Product" products and "regional participation" were gradually revealed.

"Local Participation" can not be ignored in action to sustainable regional development.

In this presentation, we report on the examination of geopark special product certification system aiming at Geopark activities that empower the area as one of attempts of sustainable regional promotion and its method.

Keywords: Mt.Kurikoma Area Geopark, Geopark, Geopark Product Certification Program, Sustainable Development, Local Participation, Empowerment

Regional resource extraction and utilization plan of embayment topography along the southern Miura peninsula, Kanagawa, Japan

Kazuki Sawamura[1], *Jiro Komori[1]

1. Teikyo Heisei University

We tried the review of local resources of Miura-city, Kanagawa. The study paid attention to the embayment topography of the shore. This presentation will introduce 1) The present conditions of Miura-shi in Kanagawa, 2) extraction of the embayment topography in the city and inventory of the cave, 3) relations of a geology and the embayment topography, 4) inflection plan of the embayment topography as local resources, 5) possibility of the application to geoparks in Japan.

Keywords: coast landform, cove, inventory, tourism resources, geosite, charms of the region

Seminars for residents about Kumamoto earthquake

*Kazuyuki Nakagawa[1], Noriko Tsumura[2]

1. Commentator ,Jiji Press, 2. Chiba University

On 2016 August four months after Kumamoto Earthquake, Seismological Society of Japan, Japan Geopark network and Aso Geopark held a seminar concerning to the Kumamoto earthquake for residents around the source region of mainshock area and Aso district.
The seminar was devided in two part: in the former part, the researchers of earthquakes, active faults, and volcanoes made lectures about the Kumamoto earthquake titled as " What was known , What has been understood, and what has not been understood"; in the later pat, pannel discussion

Keywords: geopark, Kumamoto earthquake

About the geosites reorganization work of the Happo-Shirakami Geopark

*Takuma Miwa[1], Hisato Hinuma[1], Tatsuya Shimatsu[1]

1. Promotional Meeting for Happo-shirakami Geopark

Happo-Shirakami Geopark was revalidated by Japan Geopark Committee in 2016.
It was pointed out to our geosites that scientific proof is insufficient. So we are arranging geosites information and reorganizing geosites now. We will report these process and results.

Keywords: geosites, scientific proof, concervation, Happo-Shirakami Geopark

Development of emotional intelligence using regional colours centered integrated education in cooperation with Geopark Resoaces

*Hiroyasu Nishiguchi[1], Yasuko Fujii[1], Ryota Aso[1], Ayumi Ohno[1], Hironari Fujii[1], Yu Horiuchi[2], Kentaro Tsunega[3], Noriyuki Kimura[4], Ryoji Teruyama[5]

1. Oita University, 2. Oita Himeshima Geopark Promotion Office, 3. Oita Prefectural Government, 4. Education Ministry of Oita Prefecture, 5. Oita Prefectural Arts, Culture and Sports Foundation

The Oita Prefectural Art, Culture and Sports Promotion Foundation wishes to promote human resource development in the prefecture by encouraging cooperation between the regions and the Oita Prefectural Art Museum (OPAM) through the use of art and culture. One of the main ways to do this is through education. Educational Activities are one of OPAM’s most important functions. The museum has been building up educational links in Oita by doing “outreach” work in schools and local areas.
In cooperation with the Oita Prefectural Education Board and regional education boards, and with the advice of the Education Ministry, we worked together with schools as part of a classroom teaching project called “art centered integrated studies”.
At first we decided to work on “discovering the attractions of your hometown, a heritage promoting program” organized by the Prefectural Education Board as a joint enterprise between the Foundation and Himeshima island which is located far away from OPAM which is in Oita city.
In the workshop “Making paints by using stones and soils in each region”, our museum has the theme of “making regional colours: 10,000 colors of the prefecture” and The Oita Prefectural Education Board has the theme of “one colour for each: finding a personal colour”.
In this Study, we developed the emotional intelligence using regional colours centered integrated education by cooperated with Geopark Resoaces.

This work was supported by JSPS KAKENHI Grant Number JP16H03799.

Keywords: integrated education program, regional colours, Himeshima, geopark activities

An example of geopark education practiced by cooperation between private organizations

*Toshiya Tanbo[1], Masato Fujita[2], Kazutsugu Sugitani[3], Yoshiko Masubuchi[2], Akira Takeuchi[4], Tsuneo Souma[4], Toshiko Mizuhara[5]

1. Tateyama Caldera Sabo Museum, Toyama Prefecture, 2. Toyama Science Museum, 3. Toyama Water and Culture Foundation, 4. Toyama University, 5. Tateyama Kurobe Geopark Council

In the Tateyama Kurobe area, abundant water resources exist in the vicinity of residents as a characteristic of the local social environment before Geopark accreditation, and its importance was also recognized, conservation educational activities of the water environment are active. However, the residents did not consider the geohistory of the Tateyama Mountains and the history in the composit fan delta to be involved in the formation of the water environment. Currently, Tateyama Kurobe Geopark focuses on this point and has put human resources into learning activities in the water environment.

Toyama Water and Culture Foundation has been continuously supporting children's water related learning activities from 2003, through projects targeted at elementary schools and other organizations in Toyama Prefecture. Tateyama Kurobe Geopark has participated in this activity since 2013, a Japanese geopark associate member, and dispatches staff to the site as a learning instructor of "Geopark Expedition Team".

This activity is televised all over Toyama prefecture with the cooperation of private broadcasting stations and also plays a major role in spreading the principle of geopark activities. Toyama Water and Culture Foundation was able to obtain the result that the conservation educational activities of the new cut water environment started to move. Tateyama Kurobe Geopark was also able to gain a new reciprocal relationship between private organizations.

Keywords: Geopark Education, Private Partnership

Many outcrops and fossil of the mammals in The Geopark Chichibu

*takao tomida[1], kenichi yoshida[1]

1. The Geopark Chichibu Promotion council

Six outcrops which remain in the area of the Geopark Chichibu and nine fossils of the mammals owned by Saitama Museum of Natural History were designed as a National Natural Monument in 2016. Collectively, they are called “Sedimentary layers of the old Chichibu bay, and marine mammals fossil assemblages”. Above all, searching outcrops shows the geological history of the Chichibu basin from beginning to end.

That was the first case which the geological formations and a number of fossils were designated together as a National Natural Monument in Japan. (Individually, the fossils of animals are for the third case and the fossils of mammals are for the first case.)

These outcrops and fossils had been protected by only the researchers with the results for a long time, but now the government will be saved them under the protection law. That effects the promotion for Geopark Chichibu which works for environment preservation of the monuments.

*Six outcrops
“Unconformity in Maehara”, “Unconformity in Inuki”, “A huge outcrop in Torikata”, “A big cliff, called Yo-bake”, “A conglomerate outcrop in Aratabashi”, “A fossil locality of Paleoparadoxia in Onohara”

*Mammal fossils
Fossil localities of Paleoparadoxia; [Chichibu city] Onohara, Terao, Tochiya, [Ogano town] Hannya, San-yama, [Minano town] Ofuchi

Fossil localities of whalebone whales; [Chichibu city] Onohara, Tatenuma, [Ogano town]Hannya

We installed the guide plates around them, and the Geo-tours including the introduction of those outcrops are often held by Geopark Chichibu Promotion Coucil. Viewing from the top of Mt. Minoyama located in the east of Chichibu basin reminds you of the old Chichibu bay about 15million years ago.

In spite of the active research since Meiji period, those outcrops and fossils were not familiar with the local people. However, a lot of people know those value geological places by the recent promoting activities of Geopark Chichibu Promotion Council. We conduct the lectures such as the lead to fine the vertebrate fossils which takes notice of the spongy structure of bones appearing on the surface of the rock. At the same time, you can learn how to treat fossils without losing any value when accidentally you find them. We also have the Geopark field-study excursions for elementary and junior high school students, and support for exhibition of fossils at junior high school. You can experience to make a replica of fossil at Ogano Fossil Museum.

Goepark Chichibu Promotion Council hopes that our efforts lead to discover new fossils, and we continue to research on Geopark Chichibu in order to enhance awareness.

Keywords: Chichibu, Natural Monument (Nationally Designated)

The intrusive body at the Saruodaki Falls in the San’in Kaigan Geopark is not a dike but a laccolith

*Toshiki Haji[1], Atsushi Yamaji[1]

1. Graduate School of Science/Faculty of Science, Kyoto University

The Saruodaki Falls with a height of ~60 m is one of the highlights of the San’in Kaigan Geopark, central Japan. It has been believed that a thick dike crops out there. Tsunakawa et al.(1983) obtained the K-Ar ages of 13.9 and 14.6 Ma from the intrusive body. Trends of dikes in the geopark, including the intrusive body at the waterfall, were used to argue the change of regional stress field at 15 Ma in SW Japan (Kobayashi, 1979a, b; Tsunakawa, 1986; Yamamoto 1991). The simultaneous cessation of the rapid paleomagnetic rotation of SW Japan (Otofuji et al., 1985) led researchers to argue the end of the Japan Sea opening at 15 Ma (Tsunakawa, 198; Yamaji and Yoshida, 1998). To re-examine the stress fields before and after 15 Ma, we have investigated intrusive bodies in the southern part of the geopark (Haji et al., JpGU2017, Session S-IT29).

As a result, it became clear that the intrusive body at the falls is not a dike but a laccolith. This judgement is based on the following observations. First, the boundary between the body and its host rock has undulations in a map view. The host is composed of shale generally with inclined east by northeastward at ~10° around the falls. The boundary runs approximately along topographic contour lines. In addition, the shale formation is locally bent to form monoclines near the boundary.

Keywords: San'in Kaigan Geopark, laccolith

Cretaceous granitic rocks of Mt. Shimizuyama in the Mt. Kurikoma Area Geopark, Miyagi Prefecture

*Akane Okuda[1], Hiroto Ota[1], Yuko Miyake[1], Yoshikazu Kouchi[2], Koshi Yamamoto[3], Shigeru Otoh[2], Takuya Harada[4]

1. Development of Earth Science, Faculty of Science, University of Toyama, 2. Graduate School of Science and Engineering for Education, University of Toyama, 3. Graduate School of Department of Earth and Environmental Studies, Nagoya University, 4. Mt. Kurikoma Area Geopark Promotion Committee

Introduction

Early Cretaceous Kitakami (NE) and Abukuma (SW) granitic rocks occupy Northeast Japan and are separated by the Onikobe-Yuzawa Mylonite Zone (Sasada, 1988). Mt. Shimizuyama in the Mt. Kurikoma Area Geopark is made up of Cretaceous granitic rocks. Although Mt. Shimizuyama is located to the east of Onikobe-Yuzawa Mylonite Zone traced by Sasada (1988), there are mylonitic granitic rocks in the eastern part of the Mt. Shimizuyama granitic rock body (Osawa et al., 1988), and the attribution of the body is still ambiguous. In this context, we studied the granitic rocks of Mt. Shimizuyama.

Kitakami and Abukuma Granitic Rocks

The Kitakami granitic rocks consist of adakitic and calc-alkaline to shoshonitic granitic rocks of the magnetite-series, with the zircon U-Pb isotopic age of 127-113 Ma (Tsuchiya et al., 2015) and the magnetic susceptibility (**MS**) of 500-2000*10^{-5} SI (the greatest values in the granitic rocks of Japan; Kanaya et al., 1973).

The Abukuma granitic rocks consist of non-adakitic granitic rocks of the ilmenite-series (Kubo et al., 2015), with the zircon age of 118 Ma or younger (mostly 105-110 Ma; Ishihara and Orihashi, 2015) and the **MS** of 60-70*10^{-5} SI (Kanaya et al., 1973).

Research Method

We sampled granitic rocks from the eastern (sample 1) and western (sample 2) parts of the Mt. Shimizuyama body, made thin sections, and measured mineral compositions with a point counter. We then separated magmatic zircons from the two samples, measured their U-Pb isotopic ratios with the LA-ICP-MS equipped in the Graduate School of Environmental Studies, Nagoya University, and calculated the isotopic ages. We also measured the **MS** with a WSL-C magnetic susceptibility meter.

Results

Sample 1 (38°50′05.27″N, 140°47′09.69″E): It is a sample of biotite tonalite with the size of some quartz grains reducing because of dynamic recrystallization. The probability density plot of the $^{206}Pb/^{238}U$ ages of zircons had two peaks at 104 and 117 Ma. The **MS** was 153*10^{-5} SI.

Sample 2 (38°49′26.86″N, 140°45′51.33″E): It is a sample of biotite granodiorite. The probability density plot had a single peak at 109 Ma, and the concordia age of thirteen grains forming the peak was 109.1 +/- 1.2 Ma. The **MS** was 550*10^{-5} SI.

The two samples are of the magnetite-series granitic rocks, because every thin section included 10 or more grains of magnetite.

Discussion

The mineral composition of the two samples, magnetite-series, hornblende-biotite granodiorite and tonalite with few alkali feldspar crystals, is similar to that of the Kitakami granitic rocks. The magnetic susceptibility of sample 2, over 500*10^{-5} SI, falls in the range of the **MS** of the Kitakami granitic rocks. However, the **MS** of sample 1, 153*10^{-5} SI, falls between the MS of the Kitakami and Abukuma granitic rocks. The youngest peak age of the two samples, 104 and 109 Ma, are closer to the age of the Abukuma granitic rocks (105-110 Ma). The 110 Ma or older zircons in sample 1 were likely xenocryst zircons from

the Kitakami granitic rocks (127-113 Ma) or the first phase gabbro of the Abukuma granitic rocks (126-132 Ma; Kubo et al., 2015). Thus the Shimizuyama body is lithologically identical with the Kitakami granitic rocks, although the zircon age falls within the range of the Abukuma granitic rocks.
Although we could not draw a firm conclusion, we present a dataset of the oldest rock body in the Mt. Kurikoma Area Geopark. It is our great pleasure to use the dataset for the investigation of the geohistory of the Mt. Kurikoma area and Northeast Japan.

Keywords: Zircon, Geopark

Geo factor of the 2016 Itoigawa City Station North Great Fire in Itoigawa Station, Niigata Prefecture

*Takahiko Ogawara[1], Ko Takenouchi[1], Hiroshi Miyajima[1], Yousuke Ibaraki[1]

1. Fossa Magna Museum

At about 10:20 a.m. on Thursday, Feb 22, 2016, a fire broke from the commercial stove of a ramen noodle shop north of Itoigawa Station. Carried by strong southerly winds, the fire quickly spread becoming the largest fire since 1954. It has been provisionally named the Itoigawa City Station North Great Fire (Fig. 1). The fire was first reported at 10:28 a.m. and 12 emergency response units (9 fire, 3 EMT) were dispatched by the Itoigawa City Fire Department. The firefighting activities continued, but because of the strong winds, leaping flames caused the fire spread, with the first leap recorded at 11:21 a.m (Fig. 2). The Itoigawa City Fire Department requested aid from neighboring communities which was answered by 31 units (25 fire, 6 other) and eventually 43 units were batting the fire. The local Itoigawa City Fire Department also dispatched all 50 units available in the city.

At 12:20 p.m., the City of Itoigawa ordered the evacuation of the Honcho and Omachi 2-chome districts and at 1:10 p.m. National Route 8 was closed to traffic along a 1.3 km section between the Teramachi and Yokomachi Intersections. At 1:46 p.m. the Itoigawa City Fire Department reported that the fire had spread to at least 50 buildings. At 4:30 p.m. the evacuation order was expanded to the Omachi 1-chome district. By the end, 744 people representing 363 households had been evacuated.

With regard to the firefighting activities, many fire engines from both Itoigawa City and neighboring municipalities were spraying water, overburdening the local water supplies. The city requested support as per a pre-established Disaster Agreement. The Itoigawa Regional Concrete Industrial Association provided mixer trucks to transport water and the National Ministry of Transportation Hokuriku Regional Office provided drainage pump cars to secure the water necessary for firefighting. The Prefecture of Niigata declared a State of Emergency and requested aid from the commander of the 12th Brigade of the Japanese Ground Self Defense Force stationed at Camp Soumagahara. 155 troops of the 2nd Infantry Regiment stationed at the nearby Camp Takada were dispatched at 1:30 p.m. the following day.

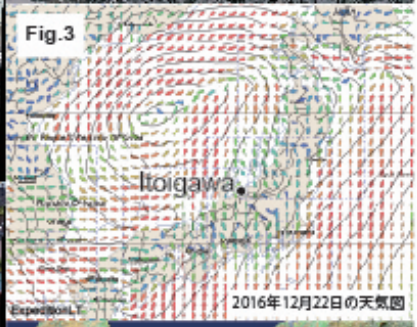
The fire was contained at 8:50 p.m. but fire suppression continued until 4:30 p.m. the next day when the last fire was extinguished. There were 17 injuries reported (2 general public, 15 emergency personnel), with one moderate injury and 16 light injuries. There were no casualties. The buildings damaged included Kaga-no-I Brewery, Niigata Prefecture’s oldest sake brewery founded in 1651; 200 year old restaurant Tsurukiya; the historic Heiando Inn and more, totaling 147 buildings (120 completely lost, 5 half destroyed, 22 partially damaged). The fire covered roughly 40,000 square meters, Japan’s largest fire in 20 years.

On the day of the fire, a low pressure area was moving east over the Sea of Japan along warm and cold fronts (Fig. 3). Before the cold front passed Itoigawa, a strong, dry southerly wind (Foehn wind) was produced. The Itoigawa City Meteorological Station recorded a wind speed of 13.9 m/s at 10:20 a.m. when the fire started and at 11:40 a.m. the Itoigawa City Fire Department reported momentary wind speeds of up to 27.2 m/s. The fire spread almost entirely in the direction of the wind. Therefore, one can suggest that this strong southerly wind is the cause of the fire’s spread.

This fire expanded as quickly as it did because of this *Renge-oroshi* wind which formed because of the nearby mountains and canyon, so this fire can be said to have a geological element (Fig. 4).

On Dec 30, Niigata Prefecture announced that the fire, which normally would not be considered a natural disaster, would be covered by the *Act on Support for Reconstructing Livelihoods of Disaster Victims*. This is the first time that a wind-borne fire has been covered by this law and this is because the *Renge-oroshi* winds can be said to have caused what should otherwise have been a minor fire to expand out of control. For this reason, the fire is being treated as a wind disaster. This is through no small part of the activities of the Itoigawa UNESCO Global Geopark, which has worked to explain and clarify the atmospheric conditions and the geographical and geological factors involved to the Japanese administration.

Keywords: Itoigawa city, Massive fire, Foehn phenomena, Renge-wind, Natural disaster, Itoigawa UNESCO Global Geopark



Research into Digital Archival concerning Disaster Monuments in the Izu Peninsula

*makoto kumagai[1,2], Yusuke Suzuki[3], Hideyuki Itoh[4], Hinako Suzuki[5], Shinichi Sugimoto[2]

1. Graduate School of policy studies, Iwate prefectural University, 2. Sanriku Geopark Promotion Council, 3. Izu Peninsula Geopark Promotion Concil, 4. Faculty of policy studies, Iwate prefectural University, 5. National Research Institute for Earth Science and Disaster Resilience

In the Sanriku Region, past tsunamis and the lessons we learned from them appear on stone monuments throughout the area.However, stone monuments for tsunamis leading up to and including that which followed the 1896 Sanriku earthquake tunami are already over 100 years old and are significantly weathered. In particular, stone monuments made with such material as sandstone and granite have significant surface weathering, and the inscriptions in many cases are difficult to make out. Such deterioration in readability due to weathering and other factors will occur to stone monuments in other regions, and there are concerns that other such monuments, including for the Genroku Kanto Earthquake tsunami in the Izu Peninsula, will also suffer from decreased readability. Further, about half of the tsunami stone monuments in the Sanriku Region suffered from flooding in the Great East Japan Earthquake, and most of these were damaged or washed away. The Izu Peninsula area is the region that will again suffer damage from tsunamis due to Tokai and Tonankai earthquakes, and we believe there is a need to preserve information on the stone monuments vulnerable to damage beforehand. In this regard, along with ascertaining the possibility of damage to stone monuments related to disasters in the Izu Peninsula, this research conducted collection, ordering and digital archiving of information on the stone monuments including details of the inscriptions, position information and three-dimensional data using photographs.

Keywords: Monuments, Digital Archives, Izu Peninsula, Genroku Kanto Earthquake tsunami, Tokai earthquakes, Tonankai earthquakes

Actual conditions of geoparks based on text mining

*Takashi Nakakushi[1], Yuki Onoda[2]

1. Faculty of Tourism, Wakayama University, 2. Faculty of Systems Engineering, Wakayama University

In the JpGU “Geopark” session in 2016, we reported the results from analysis of traffic big data, temporal variation of the number of geopark-related tweets on Twitter, and morphological analysis of geopark-related newspaper articles, in order to investigate the actual conditions of geoparks.

We report in this session further results of geopark-related newspaper article analyses using methods of text mining, including morphological analysis and co-occurence network diagram analysis. We also try to construct a database of geopark-related tweets. Some preliminary results are presented.

Keywords: geopark, text mining

Unique geological landscape of Hotokegaura,Shimokita peninsula,Aomori, Japan

*KAEDE MAESAKI[1], Hayato Ueda[1], Naoto Koiwa[2], Mio Kasai[2]

1. Niigata University, 2. Hirosaki University

Introduction: Hotokegaura in Shimokita Peninsula, Aomori Prefecture is a famous sightseeing spot. It is a rock coast made of green tuff and has unique scenery of weathering and erosion of the rocks. In September 2016, The Shimokita Geopark was certified by the Japanese Geopark Network, and the Hotokegaura geosite is one of the highlights. However, there has been no study specifically on the formation of the rocky terrain of Hotokegaura. Guidebooks and pamphlets vaguely explain only referring to general theories such as wind, rain and wave erosion. Therefore, I conducted field survey, mineralogy, and laboratory experiments to understand formation mechanism of the Hotokegaura landscape. In the research, attention was paid to the formation process and formation factors of the rock tower (pinnacle) and the longitudinal striations (rill) carved on the pinnacle surfaces, which characterizes the Hotokegaura geosite.
Pinnacle: Pinnacles occur not only on the coast but also on the hillside slopes. Rock slopes between the pinnacles show concave profiles without joint. Flake weathering, by which the rock surfaces are peeled, is evident particularly at the foot of pinnacles, resulting in notches, and the foot of such hillside pinnacle are considered being gouged. I measured the occupancy of the peeled parts on the rock surfaces. It is suggested that the peel-weathering is controlled by infiltration of groundwater since peeling tends to be active along the boundaries between wet and dry parts. Laboratory weathering experiment showed that freezing and thawing well peeled surfaces of green tuff by a similar way to that in nature.
Rill: Rill has developed on the surface of pinnacles close to the ocean and cannot be seen on the surface of pinnacles away from the coastline. Therefore, it is presumed that not only rain but also seawater greatly influences the rill formation. In addition, the rill tends to develop preferring south faces to north faces of pinnacles. It was observed that sand accumulated on the bottom of the Rill. Based on the above observations, it is predicted that the consolidated green tuff was incised by water as its surface was disaggregated to be sand particles under the influence of seawater and weather. In laboratory, salt weathering experiments reproduced sand disaggregated from green tuff surfaces as seen in nature.
Summary: Field observation and laboratory experiments lead to the ideas that pinnacles are excavated from hillside slopes as their surfaces are peeled off due to a freezing and thawing process. Rill was probably formed so that green tuff surfaces are weathered into sand due to salt weathering, and the sand was washed by flowing water of wave and rain. Further observation is necessary to ensure whether the processes deduced by experiments are really ongoing in nature.

Activity record of Children’s Summer School on Earthquakes and Volcanoes at Nanki Kumano Geopark

*Hiiro Tomoya[1], Tanaka Miho[2], Committee for Children’s Summer School on Earthquakes and Volcanoes[3]

1. Shinshu University, 2. Meteorological Agency, 3. Seismological Society of Japan

From August 19th to August 20th in 2016, the 17th Children’s Summer School on Earthquakes and Volcanoes (http://www.kodomoss.jp/) in Nanki Kumano Geopark was held. Based on the theme of "The Secrets of the Nanki Kumano's Ocean and Mountains", thirty eight children studied the meaning of their familiar sights and realized the hidden activities of the earth. They were from not only inside Wakayama prefecture but also all over the country. They visited Hashigui-iwa Rock, Ichimai-iwa Monolith, K-NET Kushimoto Observation points, etc. outdoors. While they conducted several geological experiments indoors.
We will report the secrets of the sea and the mountains in Nanki kumano discovered by children, and achievements of the Children Summer School on Earthquakes and Volcanoes in the following presentation.

Keywords: Education for disaster-prevention, Geopark, Nanki Kumano, Kii-Peninsula

