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.

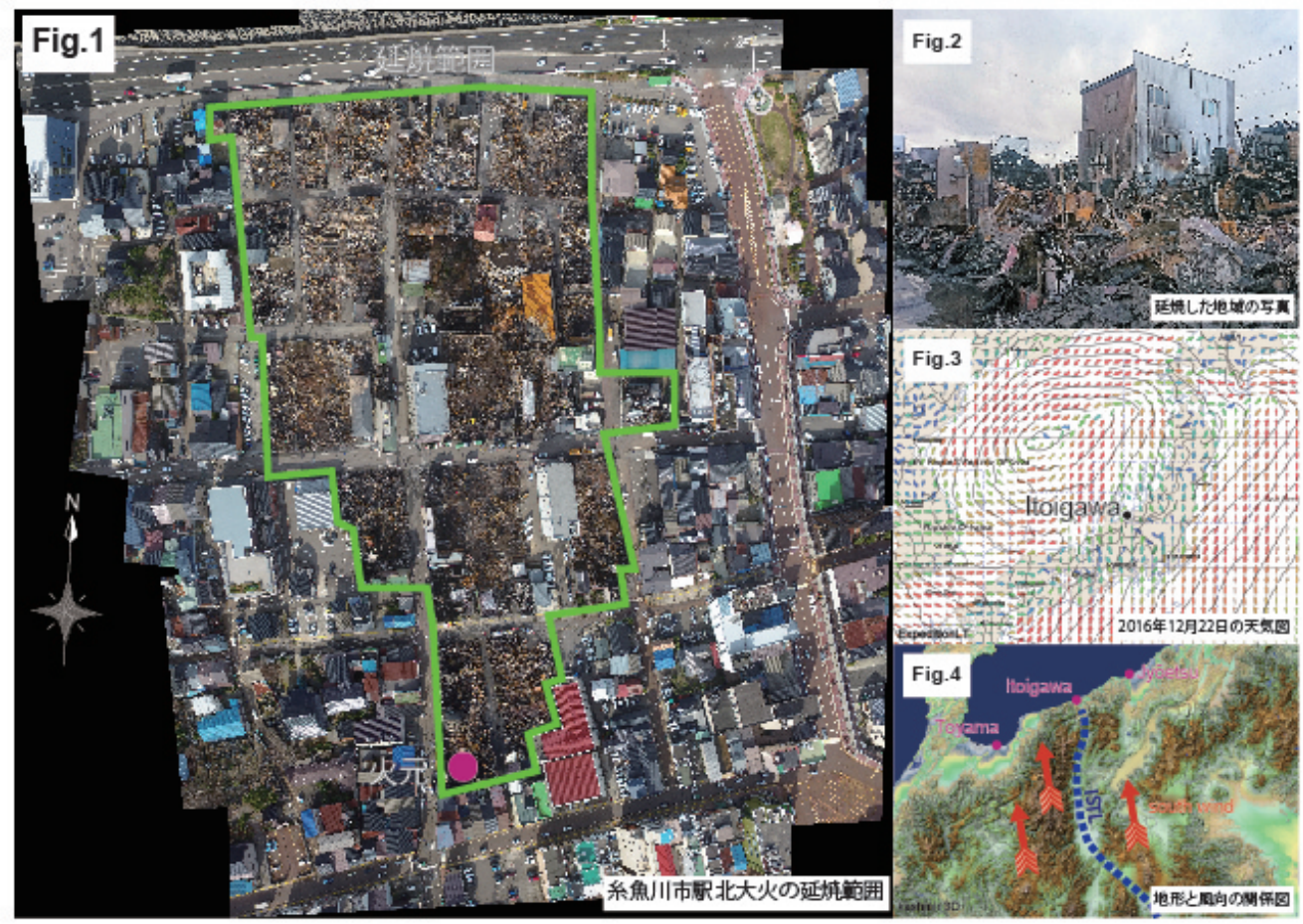
The fire was contained at 8:50 p.m. but fire suppression continued until 4:30 p.m. the next day when the last fire was extinguished. There were 17 injuries reported (2 general public, 15 emergency personnel), with one moderate injury and 16 light injuries. There were no casualties. The buildings damaged 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

