The center for Diffusion and Enlightenment of Volcanic Hazard and Risk Education on Fuji Volcano Disaster Prevention; attempt of Fuji Volcano Disaster Prevention Information Center

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It is very important that the information about potential volcanic hazards is disseminated for the public, as standing point to deepen their understanding on the volcanic hazard, and to advance the volcano disaster prevention measures. Especially, when Fuji volcano erupts by any chance, the influence extends it to not only the population in the surrounding but also the general public, therefore the volcanic hazard map was made centering on the Cabinet Office, it continued to it, and the evacuation map and booklet were made by the local disaster prevention conference.

It is an essential prerequisite for the mitigation of volcanic hazard risk at Fuji volcano that the public studies and gains its history of eruptive activity and associated hazardous processes. And a vital element of effective risk reduction is for the population at large to gain an adequate understanding of the current status of Fuji Volcano. Accordingly, Fuji Volcano Disaster Prevention Information Center (FVDPIC) is attached to Yamanashi Institute of Environmental Sciences (YIES). FVDPIC aims to offer investigation results and monitoring information to the local municipality etc., and to promote of the spread enlightenment of the volcano disaster prevention education and organizing of the system of the volcano monitoring and the volcano observation information sharing.

To advance the spread enlightenment of the volcanic hazard and risk education on Fuji volcano, the system of FVDPIC is maintained to send essential information concerning Mt. Fuji including the volcano knowledge and monitoring information. It is scheduled to be informed by the illustrated talks and animation, and to open it to the general public, who visited the center of environmental education in YIES because the well-informed populace is more likely to promote support for the geological studies, monitoring activities, and efforts at control. It attaches and it reports on the approach.

Collaboretion Program of "Hokkaido Volcano Summit", Japan

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Hokkaido Volcano Summit is a unique collaborating program among the people, officials, and scientists who are interested and concerned in active volcanoes in Hokkaido. From the historical experiences, especially after the 2000 eruption of Usu volcano, we came to the firm conclusion that working together during volcano dormancy is the best way for mitigating future volcanic disasters. Executive Committee was established shortly after the 2005 Mt. Tarumae Forum, and the first Summit was held at Sapporo in October 2005. The second Summit was held in 2006 at Iburi District where active volcanoes Eniwa, Tarumae, Kuttara and Usu were located. About 1000 people were participated altogether - (1) Hazard and Tourism Symposium on Kuttara Volcano (Noboribetsu Spa area), (2) Mt. Tarumae Summer School, (3)Display/Study Program on Disaster Related Machineries, (4) Revival Womens Police Team for the Kids (as worked during the 2000 Mt. Usu crisis), (5) Bosai Camp Eniwa, (6) Usuzan Kids Forum, (7) Mt. Tarumae Field Trip, (8) Mt. Usu Field Trip, and (9) finally the Main Symposium in Tomakomai City. The main symposium is usually consisted of basic/memorial/invited lectures, poster sessions, activity reports from the coordinating bosai committee at each active volcanoes, panel discussions, and closing event with the volcano summit declaration. The third Summit was held in 2008 in the area around Mt. Tokachidake in central Hokkaido; (1) Asahikawa Science Cafe on Ayako Miuras Nobel Deiryu Chitai (=Lahar Area), (2) Field Study Tour of Volcano Sabo Facilities by Kids with their parents, (3) Peoples Workshop in Biei Town, (4) Peoples Workshop in Kamifurano Town, (5) Lectures on Volcano Hazard Mitigation, and (6)finally two days Main Symposiums at towns Biei and Kamifurano. About 400 were participated. It was also a year of the 20th years anniversary since the all winter-long evacuation at Shirogane Spa area due to the 1988-1989 eruption of Mt. Tokachidake. The fourth Summit was held in 2012 in the area around Mt. Meakandake in eastern Hokkaido; (1) Study Climbing Tour of Mt. Meakandake by the kids in Kushiro City and Ashoro Town, (2) Study Climbing of Mt. Meakandake, (3) Study Bus Tour using new guide book Preparing the Future Eruptions of Mt. Meakandake, and (4) finally main Symposium at Marimu-kan Hall, Akan Spa - Kushiro City. About 312 were participated. We strongly believe that our mitigation ability of volcanic disaster in Japan is quite strong for the top-down vertical lines, but unfortunately not so effective for the neighboring lateral linkages. Vital hazards might occur due to such gaps. Overcoming such lateral linkage gaps, it is very important to meet together and learn each other who are struggling at each specific volcanoes. So, volcano summit had worked well in the past, but because of the further continuity and financial difficulties, we have to find new sustainable way to establish more close and effective lateral interactions.

Progress Report on the Hokkaido JICA program (2009-present) on Improvement of Mitigation and Management Ability of Volcanic Disasters for the Central and South America.

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Short training program by Hokkaido JICA had started in 2009 on the subject of Mitigation and Management of Volcanic Disasters for the Central and South America. The lectures are given at Hokkaido JICA center by various professors, technical specialists, officials and journalists who had experienced the recent eruption crises. Besides, Mr. Yamanaka, the former Mayor of Sobetsu Town gave an attractive lecture at Usu on the risk management during the 2000 Usu eruption. One unique program is a full day long discussion with two journalists (S. Sato of Muroran Minpo NP, and S. Koike, an ex-editor of Asahi NP Hokkaido Branch) under the coordination by Ui and Okada. Both journalists had a decade-long involvement of Usu volcano. Visits to Sapporo Meteorological Observatory, Geological Survey of Hokkaido, and Hokkaido Prefectural Government are included. Two main field topics; two days long visit to Mt. Tokachi, and four days to Mt. Usu. Excellent Spanish-Japanese translator, is accompanied and assists throughout the program. The original program was three years, but good reputation and the overseas requests extended the program for another 3 years. At the excursion to Mt. Usu, we take a field trails for inspecting the damages of the 2000 eruption, visit to Showa-Shinzan, summit craters and various sites. Visits also include Toyako Visitor Center, Volcano Science Museum, Mimatsu Memorial Hall, Date Bosai Center, Sobetsu Information Center, and some others. On the trails, we often meet school children groups with the guides. It is not so common in their countries. Very unique experience is the discussion gathering with the local people around Mt. Usu who experienced the recent evacuation. Common questions from the Latin American participants are; why do you still continue to live on such a risky area. Typical answer is, - because I love the area, and except certain highest risk period, it is safe and comfortable here. This volcano did show always in the past a clear precursory sign when eruption is imminent. Some people insisted frankly that it was too much overdue for them, because they keep cattles or engage fishing or farming. So, next time I might not evacuate. It is a common difficult problem in the world. We must realize the difficulties. Many programs at Usu are supported by Volcano Meisters (VM). VM is a unique certification system in Toya-Usu Global Geopark, and can be approved by the examination (combination of report, field, and interview). Expectation to the VM is the high quality key person resources in the area, who can support sustainably volcano Geopark during the dormant period, and effective risk collaboration when crisis arises. We sometimes feel that we Japanese (especially disaster officials) also need to have such intensive training course, because Japanese system is effective for top-down vertical linkage but often missing the lateral linkages.

Publication of Toya Caldera and Usu Volcano Global Geopark Guide Series

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Toya Caldera was formed about 110 thousand years ago as source of large-scale pyroclastic flow. Nakajima volcano was grown at the center of the caldera about 50 thousand years ago. Ancestral Usu stratovolcano was born 20 thousand years ago at the southern rim of the caldera. Sector collapse occurred about 7 thousand years ago. Volcanic activity of Usu volcano resumed in 1663. Since then, at least 9 explosive eruption occurred with growth of lava domes and discharge of pyroclastic flows.

In August 2009, Toya Caldera and Usu Volcano Geopark was designated as a member of Global Geopark Network. Major attractions of this geopark are landforms to learn a dynamic Earth process especially related to volcanism as well as hazardous volcanic phenomena.

We are the authors and technical editors of Toya Caldera and Usu Volcano Global Geopark Guide Series. Since 2009, this series has been published by Toya Caldera and Usu Volcano Global Geopark Council as official guidebooks. Japanese version consisting of 8 volumes has completed in 2013. Each volume is 32 pages handy booklet including full-color photographs and explanation texts of each geosites. Volume 0 provide a brief introduction of the entire geopark. Volume 1 through 7 give detailed explanation of geosites and geopoints. Publication of English version has started since 2011, and currently 3 volumes are available. Listed price is 200 yen plus sales tax each. These guidebooks are on sale at major exhibition facilities in the geopark as well as some hotels. Also available at some retail shops within the geopark.

Sustainable development of Toya-Usu Global Geopark and creating safety culture at Usu volcano, Japan - through the activities by Mimatsu Museum and Sobetsu Information Center

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Masao Mimatsu(1888-1977) was a local post master at the time of Showa-Shinzan lava dome formation in 1943-1945. He had an experience guiding the visiting professors during the 1910 eruption. So he knew what to do, and had deeply engaged voluntarily volcano observations, and abundant precious data including "Mimatsu Diagram" were left behind. Saburo got married granddaughter of Masao and both experienced the 1977 eruption. The eruption caused Saburo's admiration for Masao's works and finally he opened Mimatsu Masao Memorial Hall (Showa-Shinzan Volcano Museum) in April, 1988. It is a private owned compact, but rich informative museum. It was a year of Kagoshima International Volcano Conference1988, and shortly after the Armero disaster, so the conference was a pre-COV one. Saburo was invited and asked to display Masao's work as a week-long special exhibition. He quickly learnt the true value of the Masao's left items and got a strong new linkage with the volcanologists. The Usu area had experienced a serious social difficulty since the 1977 eruption, because of the ignorance and refusal of volcano hazard maps considering possible negative effects on tourism. But, volcanologists headed by Prof. Y. Katsui of Hokkaido University who visited Armero started to establish the regional safety culture network, avoiding the direct impact by future eruption. So, it was Saburo Mimatsu, who became the bridge with the society. Soon after, effective linkage and collaboration work were established. The '95 International Workshop on Volcanoes Commemorating the 50the Anniversary of Mt. Showa-Shinzan was the symbolic turning point accepting hazard map. Why neither casualty, nor injuries in the 2000 eruption despite eruption site was so near to the settlement? It was because collaboration between people, officials, scientists and media functioned better than our expectation, and they took an effective actions. Recovering period from the 2000 eruption impacts, local people including tourist businessmen found a new sustainable road for regional development. Many disaster sites were preserved and guided tours started by the people. First it was named "Eco-Museum", but soon it switched to UNESCO supporting Geopark program. Sobetsu town established Sobetsu Information Center (SBi) as one of its core centers. The Volcano-Hazards Study Room at SBi displays information panels and the rock samples (lava block-pumice-ash). Many shelves and cabinets stored abundant basic information on volcanoes, natural hazards, geoparks, and local histories. Most basic materials came from the retired professors and local individuals. We strongly believe such basic functions by local Museum-DataCenters are the key both for the sustainable Geopark-Geotourism development during the long volcano dormancy, and also for the future risk mitigation.

30 years-long activity of Sobetsu Kids Program at Usu Volcano, Japan

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Shortly after the Usu-Shinzan doming activity became to the end in 1982, Sobetsu Municipal Education Office conducted Sobetsu Town Collage Program. It was consist of 9 days weekend programs including various lectures and field visits to Usu Volcano Observatory (UVO) and newly uplifted crypto-dome at the summit. We realize now that many participants who took this Collage later became regional key persons during the decade-long safety culture preparedness. Because the Collage was so successful and all the 60 participants insisted their interests and the importance for everybody in the town, the Education Office found a new sustainable way for children as a Sobetsu Kids Program (hereafter SKP). Hence, SKP was created in 1983, and we, four authors of this paper, had participated in SKP over past 30 years. It is officially named Children's Study Program on the History of Sobetsu Town, and is consisting of several weekend programs. Two programs are field studies on Usu volcano (1) Showa-Shinzan lava dome and (2) the summit area of the main edifice. Mr. Mimatsu, the curator of Mimatsu Museum, participated the guide to Showa-Shinzan, and UVO staffs took the guide to the summit. Kid's parents are also welcomed. Both areas are officially closed for public access, because of the possible accidents, so we planned carefully to maintain special safety with the help of supporting staffs. Why this SKP program lasts so long. The answer is very simple and reasonable. Because it is always pleasant and enjoyable to walk, climb a little bit in the nature rich field, and listen the stories of the changing mountain over the decades. This is true not only for the children, but also for the adults. Most of them were born and grown up here, so they look the volcano upwards almost every day from their home or school. But, this is the first time to look down reversely from rugged dome peaks. Steam cooking is another attract. So, repeaters are also very common. Children grow up so fast. For example, some disaster officials during the 2000 eruption were the past SKP participants. Sometimes, university students willingly joined and enjoyed SKP. Now we realized several such members later became professionals, and took doctors degree in volcanology or relating sciences. The past US volcanologist, Harry Glicken was the one of 1987 participants. He gave a short talk in the beginners Japanese on his exciting experiences on Mt. St. Helens. Tragically, he passed away by Mt. Unzen pyroclastic surge four years later. We often talk this story with the children in the field, and try to think together what he wanted to talk to us now. In 2011 summer, Sobetsu Bosai Camp was conducted successfully despite of its short noticed schedule. This is because the area had accumulated a reservoir of supporting man powers and necessary knowledge of effective collaboration, as the result of decades-long continuing efforts during the past volcano dormancy.

Let's make Shikaribetsu lake by yourself: geopark lecture in Shikaoi elementary school

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The lecture of the Shikaribetsu lake was performed to a total of 183 children of the Shikaoi elementary school and other schools in the Shikaoi-cho geopark concept area.

The central resources of the Shikaoi geopark concept is the Shikaribetsu lake which is dammed up by lava domes. Geographycal feature of the valley was made from papier-mache. Lava domes was made from the dentistry impression material. Then water is poured into the depression by valley and the domes.

The lecturer first outlines the magma and the volcano.

Next, formation process of the Shikaribetsu lake is explained briefly, and then an experiment is started.

About 5 minutes were used to fill up the questionnaire sheet.

The three questions were set up in order to obtain degree of comprehension about the contents of the lecture.

The next three questions are for knowing intelligibility, pleasure of the lecture, and the intelligibility of the formation Process of the Shikaribetsu lake, respectively. And the last question is a comment.

Question, Do you understand the lecture?: over 90 percent of children answered "I understand the lecture" or "I understand the lecture very well"

Question, Was the lecture pleasant?: 80 percent or more of the children has answered that It was very pleasant.

Question, Do you understand how the Shikaribetsu lake was formed? : 45 percent for the fourth grade children answered that they understood the lecture very well. For the 5th and 6th grade children, it was about 70 percent.

Characteristics of hot spring water and carbonate deposit from the Obama hot spring in the Unzen Volcanic Area Global Geopark

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Many types of hot springs are located in Unzen Graben of the Shimabara Peninsula, Kyushu, Japan. Their geochemical characteristics are of Cl type (Obama hot spring) in the western side of the Unzen volcano, of SO_4 type (Unzen hot spring) in the Unzen-Jigoku fumarolic area, and of HCO_3 type (Shimabara hot spring) in the eastern side of the volcano.

Carbonate deposit (travertine) is common feature around hot springs. Its morphology, mineralogy and chemical composition provide valuable information about physical and chemical conditions of the carbonate-precipitating waters. In order to identify the formation mechanism of carbonate deposit associated with hot spring, hot spring water and carbonate deposits from the Obama hot spring at Obama Town Historical Museum (one of the geosites in the Unzen Volcanic Area Global Geopark) were investigated.

The mean temperature of hot spring water is 100.1℃ and water pH is 7.90. The chemical characteristics of the hot spring water are significantly close to those of sea water. Optical microscopic observation shows that white to yellowish-white carbonate deposits inside of an artificial metallic pipe are completely composed of acicular aragonite crystals. Electron probe microanalysis (EPMA) of the aragonites shows that their chemical compositions are significantly homogeneous throughout the carbonate deposits and no chemical variation has been observed from the outer to the inner part of them. The main component of these samples is $CaCO_3$, and Sr, Na, Mn, P, Si and S are minor components. The depositional rate of these carbonate deposits are evaluated about 1.2 mm per day. Rapid degassing of CO_2 from high temperature Mg-bearing hot spring water probably enhances metastable nucleation of aragonite crystals.

The Shinmoedake Eruption of 2011, Kirishima Volcano and Activities of Kirishima Geopark

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Kirishima Volcano is a generic designation of a cluster of Quaternary volcanoes situated at the boundary of Kagoshima and Miyazaki Prefectures, southern Kyushu, Japan. Shinmoedake (1421 m a.s.l.), an active volcano in the Kirishima Volcano, has had small eruptions from time to time since its small-scale eruption in August of 2008. On the morning of January 26, an eruption occurred without any remarkable precursor. An ash eruption blowing out volcanic ash lasted continuously from the morning to around 15:30. From about 16:00, it developed to a pumice eruption with accompanying continuous air shocks. Although the eruption calmed down after 18:00, violent pumice eruptions occurred from around 2:00 the following day until dawn. A pyroclastic flow of about 1 km long from the crater was confirmed on the morning of January 27. Pumice eruption occurred again in the evening of January 27 and continued for about 2 hr. On January 26 and 27, a volume of pumice and volcanic ash fell on the leeward areas. Moreover, from January 28 to 30, lava accumulated in the crater, and on February 1 an explosive eruption sent air shocks that broke windows and injured some people. Given these circumstances, nearby neighborhood associations have offered information on regulations regarding entry into the mountains and traffic news and have called out to residents in nearby communities to stay alert for eruptions.

In the area around Kirishima Volcano, we have been putting much effort in disaster prevention as part of promoting Geopark activities. In March of 2009, we constructed a Kirishima Volcano Disaster Prevention Map and distributed the map to residents in nearby communities and from April to May held information sessions at every neighborhood association. We believe that the smooth evacuation of residents in communities near the volcano in response to the recent eruption was a result of such preparations. We also believe that the many lectures and geotourism events about Kirishima Volcano we have thus far planned played a large role in educating the civil servants in nearby municipalities and residents of the area about Kirishima Volcano, which in turn led to their calm response to the eruption.

It might be said that the eruption of Shinmoedake in 2011 added new findings to Kirishima Geopark and simultaneously showed for the first time in the world that geoparks have extremely important roles in their disaster-prevention aspects.

Geopark investigation and geoeducation research initiatives: an example from the proposed Banks Peninsula geopark

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Banks, Peninsula on the eastern coast of New Zealand's, South Island, is a highly eroded Miocene volcanic complex where the exposed volcanic formations offer a unique view of the inner workings of a strato-shield volcano. Lava domes, plugs, dykes, spatter cones, and other volcanic features have not only spawned a unique biodiversity, but have provided a rich environment for the settlement and prosperity of pre-historic Maori (i.e. significant archaeological sites) and subsequent early European occupation (i.e. heritage sites). As such, Banks Peninsula is currently being scoped as a future UNESCO Geopark and, here, we present our methodology for achieving Geopark status while linking closely with an undergraduate research geo-education initiative.

Initial recognition of key geosites is through collation of historical datasets, previous geological mapping and studies, archaeological and cultural sites and studies, established parks and reserves, walking tracks, tourist operations, areas of ecological significance, and areas of natural significance. Investigation of geosites is being completed as part of undergraduate student research projects initiated through Frontiers Abroad (a New Zealand based study abroad programme) and the University of Canterbury. Students are deployed in field research teams, with each team member having a defined role (i.e. GIS Mapping, Geochemistry, Explosive eruptives, Lavas and intrusives, and a UNESCO Geopark representative). Each research team is deployed in an area of known geological significance, aiming to produce high resolution geological maps, stratigraphically controlled geochemical sampling and analysis, unravelling of geological histories of prominent features (i.e. dykes, domes, scoria cones, lava sequences), recognize areas of significance (i.e. biological, archaeological, cultural), produce geo-education materials, establish frameworks for geosites/trails, and collate Geopark application materials. These projects are also part of an overall research goal to produce a high-resolution geological map, stratigraphy, and research on the volcanics of Eastern Banks Peninsula.

Volcano Geoparks and the 5th International UNESCO Conference on Geoparks

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Global Geopark Network (GGN) was established in 2004 under the support by UNESCO. Presently 90 members from 26 countries are involved in GGN. Geopark is different from World Heritage Program in points of networking, educational application, local communities' development and every four-year revalidation in the former. It aims to become the UNESCO Initiative this year. Volcanoes are one of important geoheritages among these geoparks. For example, Katla (Iceland), Wudalianchi (China), Batur (Indonesia) and Jeju (Korea) Global Geoparks. Three of 5 Global Geoparks in Japan are also characterized by active volcanoes including Unzen and Usu. In Japan, there are 25 national (domestic) geoparks as of 2012, most of which includes active volcanoes or Quaternary volcanic fields in their territories. The geopark activity is one of the tools to educate visitors and local people on natural disasters including earthquakes, tsunami and volcanic eruptions. During the eruption at Shinmoekade in January-February 2011, the communities organized under the Kirishima Geopark's functioned effectively to exchange the information and take the action against the volcanic disasters. It became one of good examples of the geopark function during volcanic disasters.

Fifth International UNESCO Conference on Geoparks was held in the Unzen Volcanic Area Global Geoparks, Japan, during May 12-15, 2012. The main theme of the conference was "Earth heritage and sustainable development". Five hundred and ninety three (593) people made registration in this conference from 31 countries and areas. This was the largest number of attendees in geoparks conferences. The Shimabara Declaration affirmed in this conference includes utilization of tsunami disaster experiences of March 11, 2011 in order to mitigate future possible natural disasters in geoparks over the world. Geopark is the most effective platform to educate the natural power of our Planet and geodisasters. Roles of geoparks in climate change debate and in natural resource management were also noted. Establishment of cooperation among geopark-related communities and the importance of networking for sustainable development were also written. Community of volcanologists will be able to promote the future UNESCO Initiative as the geopark program.