Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

SVC048-P01 Room:Convention Hall Time:May 22 14:00-16:30

A study on a methodology of volcanic scenario analysis applying FEP analysis - A case study -

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The prediction technique of the volcanism is requested from the viewpoint of disaster prevention now. The prediction method using the volcanic scenario has been paid to attention. The purpose of this study is to develop the methodology of the volcanic scenario construction that the progress of the volcanic activity is predictable by progressively applying the FEP analysis methodology in the research of HLW geological disposal to the volcanic activity. A basic concept is as follows. We resolve the phenomena to compose the volcanic activity to the single-process referring to past volcanic eruptions. The single-process is arranged to the logical function theory. And, the development of volcanic scenarios is expressed as a chain of the functions. As a result, we developed adaptable volcano scenarios to the purpose. Moreover, it could be expected that the observations are made more effective by feeding back this methodology to the field survey.

Keywords: Volcanic Scenario, FEP: Feature, Event, Process, FEP Analysis, Single-process, Function, Matrix

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Dilatational crustal deformation preceding earthquake swarm activities in Hakone volcano

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Hot springs Research Institute (HSRI) has been carrying out seismic observation in and around Hakone volcano since 1968. In early times of the observation hypocenter determination was performed using S-P times read from seismograms recorded on feeding paper. It is a bit surprising to see that most of the hypocenters were determined just beneath near Owakudani in the northern part of central cones. However, having re-examined hypocenters of swarm earthquakes in 1970s using the current method of hypocenter determination, Honda et al. (2011) found out that seismic activities actually had occurred in a wider region not much different from recent activities. The seismic activity in Hakone caldera had been quiet in 1970s. Then, after rather notable activities in mid 1980s and in mid 1990s a most remarkable activity occurred in June through October in 2001 accompanying crustal deformation. Since the greatest activity in recent several decades, it is said that the over all seismicity as well as the active areas in Hakone caldera has increased (Harada et al., 2009). Having de-clustered the earthquake catalogue of HSRI, we examine characteristics of both clustered and de-clustered activities (here we call the former swarm activity and the latter background activity), noting differences in temporal changes and in spatial distributions between those two types of activities. We especially pay attention relationship between appearance of crustal deformations in 2001, 2006 and 2008-2009 and changes in both types of the activity.

From the Gutenberg-Richter diagrams it is considered that almost all earthquakes equal to or larger than M0.1 have been detected over the whole period of the examination and number of earthquakes after 2001 is more than ten times compared to that before 2000. The increase in the occurrence rate after 2001 for both swarm and background activities is clearly seen from the curves depicting cumulative number of earthquakes. However, it should be noted that apparent changes of the occurrence rate differs significantly depending on the cut-off magnitude (Mc). Dilatational crustal deformations have been observed three times by the GEONET of the Geospatial Information Authority of Japan since 2001. Although the associated changes in the occurrence rate of earthquakes are clearly seen in the catalogue of Mc 0.8, they are hardly seen in the catalogue of Mc 0.1. A notable feature is a tendency which rise of the increasing rate in the background activity and occurrence of the clustered activity are delayed to the start of the dilatational crustal deformation. This indicates that occurrence of swarm activity could be forecasted before its occurrence by noting crustal observation. It seems that no direct relationship exists between the occurrence of swarm activity and progress in the crustal deformation. This is a notable difference from the swarm activity in the east-off Izu peninsula. The b value for swarm activities is larger than that for background activities, meaning that the former activity includes relatively more small earthquakes. It implies that swarm earthquakes occupy only a small part of the energy released by the activity of Hakone volcano. The feature is also inferred from the occurrence mechanism of swarm activities suggested by Yukutake et al. (2010). We would like to note here that there is a clear difference between the swarm and background activities in the spatial distribution, where the latter is especially high in the southern part of central cones.

Keywords: Hakone volcano, swarm activity, background activity, b value, crustal deformation, forecasting

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Origin of two types of mafic inclusions for Kurodake volcano, Taisetsu volcanic group, central Hokkaido, Japan

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Kurodake volcano was formed about 0.2 Ma with andesitic lava flows. The lava flows contain a number of mafic inclusions. Two types of mafic inclusions, referred to as Fine-type and Coarse-type, are distinguished by size of microphenocrysts. In this study, we present origins of the two types of mafic inclusions.

Host lavas display a wide rage of plagioclase An content (An = 40-90). In the Fine-type mafic inclusions, the An content of plagioclase microphenocrysts has a peak between 70 and 80, which correspond to high An content of plagioclase phenocrysts in the host lavas. On the other hand, in the Coarse-type mafic inclusions, that of plagioclase microphenocrysts has a peak between 45 and 55, which correspond to low An content of plagioclase phenocrysts in the host lavas. Thus, the Fine-type is derived from foam layer of mafic end-member magma, whereas, the Coarse-type is formed by undercooling around margin of silicic magma chamber.

Keywords: mafic inclusion, magma mixing, plagioclase

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Description of the deposits of a historical small eruption in the Yatsugatake Volcano, Japan, and their significance

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The Yatsugatake Volcanic Chain, located in central Japan, has many eruptive centers and trends north~south over a distance of 21 km. Its activity started about 0.5 Ma, but many eruptive events have occurred in the surrounding area for more than 1 million years (*e.g.*, Nishiki *et al.*, 2007). Age data for each eruptive event are gradually accumulating, but few studies have investigated the younger period, in particular the Holocene.

Yokodake, located at the north end of the volcanic chain, had at least two eruptive events at about 2.4 ka and between 0.9 and 0.7 ka (Okuno, 1994). In the latter case, the Hacchodaira lava flowed from the south flank of Yokodake (Okuno, 1995).

We therefore performed a field survey in Northern Yatsugatake area to clarify whether eruptions occurred in other areas and to determine whether volcanic activity in 887 or 888 A.D. triggered the sector collapse in the Inagodake area.

We observed white volcanic ash deposits of silt-size grains in a few localities from Mt. Nyu to Sirakoma Pond. The deposits were 2.5~8 cm thick and positioned between the upper black soil and lower brown soil. The ash contained two pyroxenes, plagioclase, quartz, hornblende, and oxyhornblende phenocrysts. The refractive indices of the oxyhornblende phenocrysts in every deposit were between 1.733 and 1.752.

The ^{14}C (AMS) ages of the soil deposits covered with the white ash ranged from 415 to 585 years BP (Libby Age), *i.e.*, calendar years 1320~1465 A.D. (68.2% probability).

Because they had similar characteristics, we believe that all of the deposits recognized in this study were the same product.

The white ash may be the product of a small phreatic explosion because it lacks any fresh or vesicle grains. The distribution suggests that the source crater of this ash was between Mugikusa Pass and Mt. Nyu. The presence of oxyhornblende phenocrysts in the ash means that the source crater of this ash is in the distribution area of the Inagodake lava, which includes oxyhornblende phenocrysts.

We do not believe that any relationship exists between the eruption of this ash and the sector collapse that occurred in 887 or 888 A.D. because the ash is younger than the sector collapse. Nevertheless, determining more characteristics of the ash, such as the location of the source crater, is important for reconstructing the igneous activities in this area.

This study was subsidized by Paleo Labo Co. Ltd., Japan.

Keywords: Yatsugatake Volcanic Chain, historical eruption, volcanic ash, AMS dating

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SVC048-P05 Room:Convention Hall Time:May 22 14:00-16:30

Stratigraphy and Lithlogic Features of the Borehole Core from the Onioshidashi Observation Well, Asama Volcano

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Stratigraphy and Lithlogic characteristics of the borehole core from the Onioshidashi observation well located at the northern foot of the Asama volcano were described. The total depth of the boring reached 201m from the surface. Based on lithologic features, the core consists of three stratigraphic groups. The upper part(0m-72.4m in depth) mainly consist of andesitic pyroclastic flow deposits. The middle part(72.4m-98.3m in depth) mainly consist of andestic lahar deposits including dacitic lava fragments and pumice. The lower part(98.3m-201m in depth) consist of mafic andesitic lahar and pyroclastic flow deposits, and additional thin air fall pumice layers. Ohkuwa debris avalanche deposit that formed in the late stage of Kurofu volcano and pumice flow deposits associated with plinian eruptions of Hotokeiwa volcano are absent. K-Ah tephra (ca.7.3ka) was found in a soil layer depth in 51.3m. Pyroclastic flows near this horizon are significant to clarify the eruption style of initial stage of Maekake volcano.

Keywords: Borehole core, Asama volcano, Eruptive History, Lahar, Pyroclastic flow, K-Ah tephra

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SVC048-P06 Room:Convention Hall Time:May 22 14:00-16:30

K-Ar ages of post-caldera volcanic products from Aso volcano, central Kyushu, Japan

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The geochronological and geochemical data of post-caldera volcanic products are expected to provide us key information about magmatic evolution process and magma plumbing system after the formation of caldera.

Aso volcano, situated in central Kyushu, produced four gigantic caldera-forming pyroclastic eruptions (Aso-1 to Aso-4) between 270 and 90 ka. On the other hand, the post-caldera volcanism (after 90 ka) is characterized by multiple effusive eruptions from several vents, and formed the present central cones inside of caldera (Ono and Watanabe, 1985). The drastic change of eruption style during caldera formation probably reflects the change of magma-plumbing system beneath caldera. To clarify the detailed temporal change of the magma-plumbing system, the absolute age dating of volcanic products is necessary. We, therefore, determined the K-Ar ages for several lava units of the post-caldera volcanic products from Aso volcano.

The argon isotopic ratio was measured using a noble-gas mass spectrometer MS-IV (modified VG-5400) in the Geochemical Research Center, Graduate School of Science, The University of Tokyo. In this study, the radiogenic 40Ar contents of samples were determined by using the sensitivity method. In this method, the unknown concentration of 40Ar contained in a sample is determined by comparing its 40Ar peak intensity with that of a standard air sample whose 40Ar concentration is known. The isotopic composition of the initial 40Ar/36Ar ratio of the sample that differs from the modern atmospheric value of 296 was determined with correction of mass-dependent fractionation based on measured 38Ar/36Ar ratio (Takaoka et al., 1989).

K-Ar ages of the following lava units were obtained.

1) Tateno lava: 60-50 ka, 2) Matsunoki lava: 80-70 ka, 3) Okamadoyama lava: 70-60 ka, 4) Hakusui lava: 40-30 ka, 5) Akase lava: 40-30 ka, 6) Otogase lava: 20-10 ka, 7) Eboshidake lava: 40-30 ka, 8) Karisako lava: 40-30 ka, 9) Narao-dake lava: 20-10 ka.

These obtained eruption ages are quite consistent with stratigraphic succession which was established by the previous geological studies (e.g., Ono and Watanabe, 1985).

Keywords: K-Ar age dating, unspiked method, Aso, post-caldera volcanism, central cones

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Volcanio stratigraphy on the central part of Kozushima Volcano, based on JMA volcano-observation drilling core

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Volcano stratigraphy of Kozushima Volcano, based on the JMA boring core

Japan Geoscience Union Meeting 2011
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SVC048-P08 Room:Convention Hall Time:May 22 14:00-16:30

Sr isotopic ratios of volcanic rocks from Nekodake in Aso area, Central Kyushu

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Nekodake is located in eastern side of Aso central volcanic cones in Aso caldera, and consists of volcanic products. Its volcanic products are lava, agglutinates, pyroclastic rocks and dykes. Nekodake is a volcano, because dykes radiating from center of Nekodake and each unit of lava flows distribute in parallel with the slopes. Although Nekodake was recognize as one part of Aso central volcanic cones, it was defined as an older volcanic body, because the characteristics of bulk major elements are different and it is covered Aso-3 pyroclastic deposites (Ono and Watanabe, 1985). K-Ar datings show 0.15-0.14 Ma and 0.11-0.09 Ma of Nekodake volcanic rocks (Itaya *et al.*, 1984 and Matsumoto *et al.*, 1991, respectively). These ages were between Aso-2 and Aso-4, but Shinmura *et al.* (2010) reported that bulk rock Sr isotopic ratios and REE contents of Nekodake volcanic rocks were clearly different of volcanic products in caldera forming and inter caldera stages.

In this study, volcanic rocks were sampled at Nekodake widely and bulk rock chemical and isotopic data were determined. Range of SiO_2 content was 53-60 wt. % and of $^{87}Sr/^{86}Sr$ was 0.7041-0.7047. Sr isotopic ratios of Nekodake was higher than those of Aso pyroclastic deposites (0.7040-0.7042) (Hunter, 1998), and was higher than those of volcanic rocks of post caldera and pre caldera (Shinmura et al., 2010). Crustal xenoliths consists of quartz and feldspar are included in volcanic rocks of Nekodake. Sr isotopic ratios of these xenoliths were 0.7046-0.7055 and higher than those of Nekodake volcanic rocks. One of the xenolith shows inter-finger structure with magma, and this is an evidence of magma process assimilating of crustal material.

Star mark in Fig 1 shows the data that is the most lower Sr isotopic ratio, is basalt which was lower defferentiated. Most of the data distribute along the line from the star mark to the area of higher Sr ratios as xenolith's (0.7046-0.7055). This shows that the original magma which component was as star mark assimilated crustal material, and the variety of Sr isotopic ratios were depend on the assimilation process.

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Shinmura T., Arakawa Y., Miyoshi M. and Shibata T. (2010): Temporal change of geochemical characteristics of volc rocks from Aso: Implication for a prediction of super eruption. summary of JGU Meeting 2010.

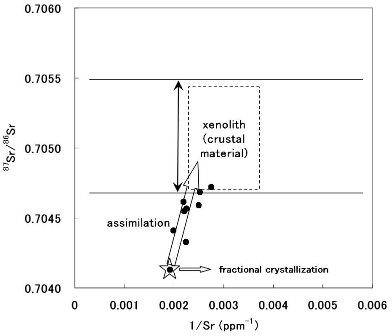

Fig 1. 1/Sr vs. $^{87}Sr/^{86}Sr$ diagram for the Nekodake volcanic rocks.

Keywords: Nekodake, Aso, Sr isotopic ratio, mixing of crustal materials, xenolith

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Occurrence and microtexture of the mafic obsidian from the late Miocene basaltic plateau in the Primorye region, Russia

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We introduce the mafic obsidian consisting of andesitic glass (SiO_2=56-59wt.%) without microlites (more than a few micrometers in size), which are found in the chilled margin of pillow lavas and hyaloclastites and of thin lava flows from the late Miocene basaltic plateau (Shkotovo plateau and Shfan plateau) in the Primorye region, Far East Russia (Popov et al.,2009). The chilled margins of mafic obsidian are more than 1 cm in thickness in their outcrops commonly, and they are found as cobbles with several to 10 cm in size. Furthermore the chilled part extends to the pillow interior to produce the large mafic obsidian. The mafic obsidians are black, dark-blue, and deep gray in color. These features show that the mafic magmas with low viscosity and high temperature were transformed into andesitic glasses under super cooling condition. It is possible to attain the high super cooling condition if the mafic magmas were erupted under the ice sheet during the ice age of 14-13 Ma.

Keywords: mafic obsidian, basaltic plateau, Far East Russia, pillow lava

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Textural characterisation of Volcanic Debris Avalanche Deposit matrix through field and SEM study

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Volcanic Debris Avalanches (VDA) constitute a major hazard in volcanic areas, especially as it can travel long run-out distance unlike non-volcanic landslide. To understand mechanisms of emplacement of VDAs is thus essential in view of hazard mitigation.

Until now, scientist community tend to agree on the importance of the matrix in VDAs transport. However, it stays unclear how matrix form and in which manner it helps VDAs transport. Internal deformation, stresses repartition, and how the matrix acts to allow such long distance of transport remain obscure. Similarly, does the matrix behave as laminar or turbulent flow or is it a combination of both processes?

To answer those fundamental questions, we propose to use field and SEM data. Outcrop and micro-scale structures such as striation, tension gashes, hackle fractures etc can give some insights onto matrix formation and role in VDAs emplacement.

Keywords: Volcanic Debris Avalanches, Matrix, Structural characteristics, Emplacement mechanisms