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

SVC051-P01 Room:Convention Hall Time:May 22 10:30-13:00

Compositions of slab-derived fluids and magma generation process beneath volcanic front of Kyushu arc

Tomohisa Tamura[1*], Toshiaki Hasenaka[1]

[1]GSST, Kumamoto University

This study presents data for major and volatile (H2O, CO2, S, Cl) elements in olivine-hosted melt inclusions from four Quaternary volcanoes (Aso, Kuju, Kirishima, Kaimon) along volcanic front of Kyushu arc. The primitive magma compositions calculated from melt inclusion data are used to estimate the degree of partial melting and the compositions of slab-derived fluids beneath Kyushu volcanic front. The results show that magmatism of four volcanoes in Kyushu arc is divided into two groups; A) high K2O contents in primitive magmas and in fluids at Aso and Kuju volcanoes, northern Kyusyu arc, B) low K2O contents in primitive magmas and in fluids at Kirishima and Kaimon volcanoes, southern Kyushu arc. High K2O content in fluids is attributed to dehydration of phengite-bearing slab at deep depth (about 140 km) in group A compared with shallow depth (about 100 km) in group B. K2O contents in primitive magma and fluids are attributed to the depth of slab beneath volcanic front of Kyusyu arc. The amount of both slab-derived fluids and degree of partial melting for Kaimon volcano are lower than others. This may be affected by subduction of old and cold slab in southern Kyushu arc. Slab-derived fluids are important to evaluate magmatism beneath volcanic front of Kyushu arc because these decrease the solidus temperature of source mantle and also facilitate mantle melting, and then generate diversity of primitive magma composition.

Keywords: melt inclusion, slab-derived fluids, island arc

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

SVC051-P02 Room:Convention Hall Time:May 22 10:30-13:00

Analytical solutions giving shape of laccoliths due to overpressure distribution expressed by Fourier series

Shigekazu Kusumoto[1*], Akira Takeuchi[1]

[1]Grad. Sch. Sci. Eng. Res., Univ.Toyama

We derived analytical solutions giving shape of laccoliths due to overpressure distribution expressed by Fourier series. As Fourier series can describe all overpressure distribution including arbitrary discontinuity and/or asymmetry, the solution shown in here is a general solution that describes the shape of laccoliths. In this paper, we show laccoliths shape reflecting asymmetric overpressure distribution given by $p(x)$=exp$[ax]$ (a = 0, 1, 2, 3), as numerical example. If the overpressure were expressed by even function, the shape of laccoliths is given by the Fourier cosine series. Under this condition, we obtained solution for inverse modeling estimating overpressure distribution from shape of laccoliths, by changing our solution form. As numerical test, we attempt to restore an assumed overpressure condition from the shape of laccoliths calculated under the condition of which the overpressure is constant and/or is given by $p(x)$=exp$[3|x|]$. As a result, it was found that our solution gives overpressure distribution correctly from laccoliths shape.

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

SVC051-P03 Room:Convention Hall Time:May 22 10:30-13:00

A proposal for future rover exploration targeting volcanic activity on Mars

Noriyuki Namiki[1*], Tomoko Arai[1], Masanori Kobayashi[1], Hiroki Senshu[1], Kazuhisa Goto[1], Koji Wada[1], Sohsuke Ohno[1], Ko Ishibashi[1], Shingo Kameda[1], Tomohiro Usui[2], Goro Komatsu[3], Hideaki Miyamoto[4], Shogo Tachibana[4], Seiji Sugita[4], Yayoi N. Miura[4], Yuichiro Cho[4], Tatsuaki Okada[5], Makiko Ohtake[5], Takashi Kubota[5], Hirohide Demura[6], Yoshiko Ogawa[6], Noriaki Asada[6], Naru Hirata[6], Kohei Kitazato[6], Kyoko Okudaira[6], Junya Terazono[6], Yukihiro Takahashi[7]

[1]PERC/Chitech, [2]JSC/NASA, [3]IRSPS, [4]The University of Tokyo, [5]ISAS/JAXA, [6]The University of Aizu, [7]Hokkaido University

We are proposing geologic studies of martian volcanism using a rover in a future Japanese mission to Mars, MELOS. In MELOS mission, three exploration plans are currently argued; (1) two orbiters to observe magneto-electric field and ion escape flux from martian upper atmosphere, (2) a climate orbiter to monitor atmospheric motion and gas distribution, and (3) lander(s) and/or a rover aiming to understand internal structure of the planet, geologic evolution of the surface environment, and a search for life.

The third plan is further divided into four proposals; (3.1) seismic and geodetic observations, (3.2) rover geology, (3.3) astrobiological search, and (3.4) atmospheric sample return. In this talk, we introduce (3.2), and in particular, geologic exploration of martian volcanoes.

Ultimate scientific goal of Mars exploration is, needless to say, a search for extra terrestrial life. After a series of Mars explorations since 1970's by orbiters, landers, and rovers, it became clear that sudden climate change from wet and warm weather to cool and dry weather took place on Mars billions years ago, and that a presence of life in a current martian environment is unlikely. Then ongoing mission plans led by NASA and ESA (European Space Agency) are focusing on analysis of sedimentary rocks aiming to reveal a history of surface environment on Mars. Here we propose a different strategy to study an evolution of the surface environment.

In order to understand sudden climate change in early martian history, it is very important to evaluate both input and output of atmosphere. The former is likely influenced by massive volcanoes such as Tharsis riseand Olympus Mons, and the latter is controlled by atmospheric escape processes. Recently Bibring et al. (2005) have proposed that large amount of volcanic degassing during late Noachian and early Hesperian radically changed oxidized state at the Mars surface and caused martian climate change. This hypothesis, whether true or false, suggests that volcanoes played a key role in climate change of the planet.

We propose to land a rover on Mars in early 2020s to study (i) development of volcanoes and mechanism of eruption, and (ii) magma process. In the view of martian climate change, we are mostly interested in (ii). A rover that is under development by JAXA, Tohoku University, Chuou University, and Meiji University has a capability to move over a distance of 1 km or more in a nominal mission period. Robotic technology allows us to find and examine in detail outcrops of thick lava and volcanic rocks by using several instruments such as (i) multi-spectral camera, (ii) macro camera, (iii) laser induced breakdown spectroscopy, (iv) X-ray fluorescence densitometry, (v) mass spectrometer, (vi) magnetometer, (vii) ground penetrating radar.

Keywords: Mars exploration, Rover