Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

SVC53-P01 Room:Poster Time:April 28 18:15-19:30

Identification and Geology of Taftan volcano Calderas, Sistan and Baluchestan, Southeast of Iran

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The Taftan volcano, Sistan and Baluchestan province, SE Iran, is above 4050 m sea level and currently dormant, showing fumarolic activity near the summit. This volcano is located in a structural zone along the subduction of Oman oceanic crust below the Eurasia plate. Large volcanic centers including Chah-Shahe, Bazman and Taftan in Iran and Soltan in Pakistan have been developed during the Quaternary. Anjerk and Tamandan are two calderas from of Taftan volcano that identified for the first time. Theses calderas are mostly composed of pyroclastics, lava flows, ignimbrites and tuffs. Various volcanic eruptions had occurred during these calderas formation. The exposed lava flows and pyroclastics of these calderas mainly consist of andesitic and dacitic in compositions. The geochemical evaluation of the major and trace element compositions indicate the magma erupted from this volcano show a calk-alkaline trend.

Keywords: Taftan Volcano, Makran belt, Anjerk caldera, Tamandan caldera, Geochemical evaluation, Iran

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K-Ar ages of Kelut-Welirang volcano cluster, East Java, Sunda arc: comparison with clusters that hosts large calderas

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Sunda arc, Indonesia, has many active caldera volcanoes and is well suited for studying the evolution of large caldera systems. Volcano groups are distributed in clusters at Sunda arc. Two adjacent volcano clusters in East Java, Semeru-Tengger and Kelut-Welirang, are compared. Semeru-Tengger volcano cluster consist of Semeru and Tengger-Bromo volcano systems. Tengger-Bromo system has formed Ngadisari and Sand Sea calderas. Kelut-Welirang volcano cluster consists of multiple active volcano groups and has comparable footprint and cumulative volume as Tengger-Bromo. However, large-scale eruptions in the order of 10km3 or greater have not taken place at Kelut-Welirang volcano cluster.

Kelut-Welirang volcano cluster consists of five volcano groups. They are Penanggungan, Arjuno-Welirang, Argowayan, Butak-Kawi-Panderman, and Kelut from northeast to southwest. They are classified as active volcanoes except for Argowayan, and Kelut is currently active. However, their formation ages are not understood.

K-Ar dating is performed in order to determine and compare the long-term activity of the two clusters. Mass fractionation correction method is used for argon measurement, for many of the samples are very young. Samples with crystalline groundmass are selected for dating to obtain precise and reliable age. Groundmass is separated from phenocryst and used for dating.

The active periods and the ages of the volcano groups are identified by K-Ar dating as follows. (a) Argowayan, which consists about half of the volume of Kelut-Welirang cluster, has formed between 1.0-0.8Ma. (b) There was long dormancy in the area of this cluster, and the four volcano groups have formed within the past 0.2 m.y. (c) Kelut has started to form by 0.2Ma, and has repeatedly produced lava domes to present. (d) Much of Butak-Kawi-Panderman has formed around 0.2Ma. The group is considered active, but the long-term eruption rate of the group has decreased substantially since the early stage of edifice building activity at 0.2Ma. (e) Arjuno-Welirang is younger and likely started to form by 0.1Ma. (f) Penanggungan is the youngest volcano group and likely to have formed within the past 0.05 m.y.

The obtained ages allow us to compare Kelut-Welirang and Tengger-Semeru volcano clusters. Although Kelut-Welirang cluster has comparable volume to Tengger-Semeru, it consists of separate volcano groups formed at different ages. The long-term eruption rate for the past 0.2Ma is relatively large, but much of the erupted volume is contributed from new volcano group. In contrast, the volcano edifices of Semeru-Tengger have almost entirely formed from 0.5Ma to present. The eruptive centers are concentrated at Tengger and Semeru, and have repeated active periods.

Keywords: age dating, Quaternary, Indonesia, mass fractionation correction method

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Correlation between petrology and magneto-stratigrapphy of Holocene volcanic products from Aso central cones

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We collected samples from 25 sites where Yato et al. (2013) and Miyabuchi et al. (2012) reported magneto-stratigraphy of six different lava flows distributed in the northwestern region of Aso central cones. We conducted petrographic descriptions and chemical analyses of these samples and correlated them with paleomagnetic directions and stratigraphy of Miyabuchi (2009) based on radiocarbon dating.

Kijimadake lava is divided into two lava flow units with different paleomagnetic directions suggesting interval of at least several hundreds of years. They show the same mineral assemblage, but different groundmass texture, modal composition and whole-rock chemical composition. The upper lava flow unit has the same petrological characteristics as Kishimadake scoria, whose estimation age was 4000 y.b.p. from the radiocarbon dating.

Possibility of multiple eruptions has been suggested for Ojodake lava flows, because they are intercalated by soil, and show different paleomagnetic directions. However, no distinction was made in petrographic descriptions and chemical compositions between these lava flows.

Six different lava flows younger than Akahoya tephra have similar appearance and similar petrographic characteristics, however they are distinguishable by chemical compositions. Lava flow units with possible simultaneous eruptions (e.g. old Kijimadake lava and Nakadake younger stage lava, Kamikomezuka scoria and old Ojodake lava) show about 1% difference in SiO_2 content. A series of Holocene lava flows in Aso central cones are possibly derived from a common magma supply system with different conduits.

Keywords: post-caldera central cones of Aso volcano, volcanic products, Holocene, paleomagnetic directions, petrography, chemical compositions

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Magma genesis of Miocene basalts from Ootsu district, Yamaguchi Prefecture, SW Japan arc

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The geological, petrological and geochemical studies of Miocene Ootsu basalts, distributed in Tsunoshima and Yuyashima islands along the coast of the Japan Sea, revealed the temporal and vertical changes in mantle melting processes. Based on their volcanic stratigraphy and petrological data, Ootsu basalts were grouped into; (1) clinopyroxene-olivine basalt (COB), (2) olivine basalt, magnetite-rich type 1 (MRB1), (3) olivine basalt, magnetite-rich type 2 (MRB2), and (4) olivine basalt, magnetite-poor type (MPB). MRB1 and MRB2 are rich in FeO$*$ and TiO_2 contents, and MPB is rich in SiO_2 and Al_2O_3 contents. MRB1, MRB2 and COB are alkalic and MPB is tholeiitic.

Phase diagram and mass balance calculations indicate that these four groups were derived from different primary magmas, and had experienced polybaric crystallization. The compositions of primary magmas for these four groups suggest that MRB1 and MPB were generated at the deepest and shallowest depths, by the lowest and the highest degrees of melting, respectively. Multi trace element plots (normalized by the primitive mantle values) of Ootsu basalts show the strong enrichment of LILE (Rb, Ba, and K), and distinct negative anomaly of Nb and Sm. The compositions of coexisting olivine and spinel (OSMA) suggest that MPB's mantle source is the most fertile among four groups. The different ratios of LREE/HREE among four groups suggest different mantle source and different degree of partial melting. B/Nb ratio of four groups is getting higher with decreasing segregation depth. These systematic differences in B/Nb ratio indicate that the upper mantle beneath Ootsu district is characterized by an increased degree of metasomatism at shallow level.

We concluded that the diversities of chemical composition in Ootsu basalts attribute largely to different segregation depth and heterogeneous mantle source.

Keywords: alkaline rock, tholeiite, boron, rare earth element, mantle

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Rifting- and subduction-related volcanism of the northern Fossa Magna related to the formation of the Sea of Japan

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Specific aims of the research are; 1) to characterize the chemical composition of the magmatic sources for the Cenozoic volcanic suite in the Fossa Magna region, a boundary fault zone between north and south Japan, 2) to relate the magmatic evolution to the simultaneous tectonic process of the opening of the Japan Sea, and 3) to assess the role of rifting and subduction processes in the evolution of the continental margin of the northwestern Pacific rim with inferences for the other tectonic zone.

Keywords: Fossa Magna, Yamato Basin, MORB source, Enrich mantle

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The Middle Miocene tectonics and volcanism in the intra-arc and the back-arc region, Northeast Japan

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In northeast Japan, many submarine volcanic rocks related to opening of the Japan Sea in the Early Miocene are widely distributed. They are very important to consider the evolutional process of Japan Arc and to elucidate the submarine volcanism. Despite the importance, there were no detailed sedimentological studies of these volcanic rocks, and the detailed sedimentary processes, sedimentary basin formation, paleo-volcanism and tectonics were poorly understood. In this study, we tried to reconstruct the detail volcanic edifices and volcanism based on the facies analysis of volcanics in typical two area; one is Ou Backbone Ranges in Nishiwaga town, Iwate prefecture and the other is Dewa Mountains in Sakata, Yamagata prefecture, that were located in the intra arc and the back arc in the Miocene respectively.

As results, we could elucidate paleo volcanism in each area. Remarkable tectonic change occurred in 15Ma with active volcanism, counterclockwise rotation and rapid subsidence (Hosoi et al., 2013). Regional paleostress around 15 to 12Ma is NW-SE tensional stress (Otsuki, 1989; Hosoi, 2013). This tectonic change happened in 15Ma with opening of Japan Sea, and active bimodal volcanism, rotation movement and tectonic subsidence occurred.

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Keywords: Miocene, tectonics, back-arc, intra-arc, greentuff, Northeast Japan

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Paleostress analysis of dilational fractures using genetic algorithm

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The attitudes of dilational fractures, including dikes and veins, are clues to the paleostresses under which the structures were formed. A software tool for clustering their 3D orienatations has been developed in this study. The software fits mixed Bingham distributions to them, and detects girdle, elliptical and circular clusters. In addition, it determines the three principal stress axes, stress ratios and maximum fluid pressure for each of the clusters. Fitting a mixed Bingham distribution is not a well posed problem, because the mathematical inversion is highly non-linear and its object function is multimodal. It is demonstrated that genetic algorithm is more effective than the expectation-maximization algorithm which was used by previous researchers (Yamaji and Sato, 2011).

Keywords: real-coded genetic algorithm, magma pressure, mixed Bingham distribution, dike, vein