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Abstracts Volume

Puerto de la Cruz

Tenerife, Canary Islands, Spain

May 31 - June 4, 2010

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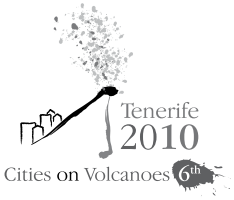
ABSTRACTS VOLUME



Cities on Volcanoes 6
CONFERENCE

Puerto de la Cruz
Tenerife, Canary Islands, Spain
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1.1-O-01

Mass Rate Trends From Different Magma Sources During The 2001 Etna Eruption

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Effusion rate greatly influences lava flow emplacement thus it is important to model its variation for hazard reduction. Previous works generally relate observed trends to the emptying of a pressurized enclosed system or to magma overflows from summit craters. Nevertheless it is also influenced by thermal effects which can cause dike closing or widening, depending on the balance between heat supplied by the magma and heat transferred to the surroundings. This work reconstructs the mass rate trends of seven fissures, belonging to two different systems (upper, US, and lower, LS), opened during the 2001 Etna eruption. Mass rate were evaluated instead of effusion rates because the US activity was purely effusive while that of LS was both effusive and explosive, thus the emitted products had different densities. The LS mass rate trend presents the two phases connected to the emptying of a pressurized reservoir: the rapidly rising phase (waxing) followed by an exponential decline (waning). Nevertheless the explosive activity, accelerating the rising and expanding magma, leaded to a constant effusion and a linear decrease that preceded the waning phase. The US behaves as a semi-open system, indeed it shows two phases of quite constant mass rate similar to overflows from Etna summit craters. Nevertheless it ended with a final phase of decreasing mass rate and a queue that can be related to the hydrostatic pressure of the remaining magma column coupled with dike cooling and closing. This work demonstrates that explosive activity makes mass rate more complex than the waxing-waning trend previously defined. Moreover it individuates a new eruptive behavior, that is the discharge from a semi-open system. The presented data might be used to model the influence on mass rate of the elastic and thermal behavior of the feeding dike and of the reservoir.

1.1-O-02

Giant, Eruption-Triggered Ocean-Island Landslide at Tenerife: Onshore Record and Long-Term Effects on Pyroclastic Dispersal

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We report the discovery of an extensive debris-avalanche deposit on Cañadas volcano, Tenerife. The onshore component of the Abona landslide is superbly exposed across 90 km^2 and preserves classic jigsaw-fit 'block facies' and 'mixed facies'. It was demonstrably triggered by an explosive eruption, and is dated at 733 ± 3 ka by $^{40}Ar/^{39}Ar$ on sanidines. Evidence it occurred during the ignimbrite-forming phase of a Plinian eruption includes: (1) the deposit forms part of a single eruption-unit in which the deposit is enclosed by phonolitic ignimbrites and preserved hummocks are draped by a Plinian layer; (2) it contains prismatic-jointed blocks of pumiceous phonolite that were clearly hot during emplacement, indicated by chilled rims and bread-crusting; and (3) the juvenile blocks in the deposit and in the associated ignimbrite and pumice fall deposit all yield the same $^{40}Ar/^{39}Ar$ date within error. Debris-avalanche hummocks dammed surface water forming ephemeral lakes perched on the volcano flank. Phonolite dome growth destabilised the SE sector of the mid-Pleistocene Cañadas caldera wall and the landslide created a major breach that affected the pyroclastic density current dispersal on Tenerife for 0.5 mys, demonstrating that landsliding at large volcanoes can have enduring geomorphologic consequences for pyroclastic dispersal and hazards.

1.1-O-03

Bimodal Volcanism In Tenerife - An Anatectic Origin For The Teide-Pico Viejo Phonolites

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The Teide-Pico Viejo central complex on Tenerife shows a distinctly bimodal composition of erupted lavas. Eruption volumes indicate that fractional crystallisation may not have been the sole cause for this phenomenon. Whole-rock trace element data divide lavas into three compositional groups on the basis of their trace element fingerprints and allow to demonstrate statistically that each of the three groups originated through a combination of processes distinct from the other groups. Using groundmass Sr-Nd-Pb along with groundmass/feldspar d18O data, we constrain the petrogenesis of the erupted products of Teide-Pico Viejo and its associated rift zones. Sediment, hydrothermally altered components or seawater influences are unfeasible as major contaminants to explain the origin of the recent phonolites. The $^{206}Pb/^{204}Pb$ of the phonolites is tightly confined, while $^{207}Pb/^{204}Pb$ shows variability comparable to the primitive lavas. This suggests that instead, the phonolites have largely been derived from partial melting of igneous country rock with varying amounts of subsequent assimilation and fractionation in shallow magma chambers. Progressive melting, from selective to bulk, of intrusive rocks related to older phonolitic successions (e.g. nepheline syenites) allows to produce

Japan Sea. The estimated eruption age from AMS ^{14}C dating of planktic foraminiferal is about 20 to 22 cal ka BP (Domitsu et al. 2002). On the other hand, the ^{14}C ages of the Shimizuhara pyroclastic flows (Fukumoto and Miyake 1994) overlying the KsP are scattered beyond measurement error (18,100±180 BP by Miura and Hayashi 1991, 17,440±150 BP and 17,440±100 BP by this study). The calibrated dates for the Shimizuhara pyroclastic flows are almost correlated to the ages of KsP obtained from marine core. AMS radiocarbon dating in this study was performed under the Common-Use Facility Program of JAEA.

1.1-P-60

Colli Albani Volcanic District Structure Revealed By Three Dimensional Gravity Field Modeling (Rome, Italy).

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Understanding the factors controlling the most recent hydromagmatic activity at the Colli Albani Volcanic District is crucial for the assessment of volcanic hazard in the densely populated area of Rome. At present, the area is characterised by almost continuous low-level seismic activity and by the presence of an intense deep CO_2 degassing process.In order to assess the inner structure of the volcanic district, we carried out a detailed gravity survey, more than 900 new prospecting gravity stations. 3D gravity modelling reveals the previously unknown geometry of the dense substratum of the Vulcano Laziale (VL) and evidences the presence of a collapsed structure beneath the caldera filled up with low density material. A complex system of faults surrounds the volcanic area. Many tectonic lineaments with prevalent Apennine and anti-Apennine directions can be singled out; some of these are quite coincident with the volcanic fault lines. This zone could have guided both the development of the volcano activity and the emplacement of the VL caldera and hydromagmatic maars. The VL caldera collapse area enclosed by these two structures is elliptical and about 20×30 km in size. Our observations suggest an asymmetric subsidence along the fault zone resulted in trapdoor subsidence in the western part. Other new information regards the Colli Albani structure. It consists of a circular volume of rocks around the Campi di Annibale volcanic vent and that extends down to the carbonate basement. It results to be denser with respect to the surrounding sedimentary cover of the Vivaro Plain and to the material located just along the central axis of the volcanic structure.

1.1-P-61

Petrochemical Characteristics of Gorely Volcano (Southern Kamchatka) Magmatic Series

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Gorely volcano is the largest eruptive center in Southern Kamchatka. It's comprised of several structural units. Geochemical studies have been conducted on all structural units of the Gorely volcanic edifice to determine their genetic conditions. After geochemical analysis two evolution series were found. First, Pra-Gorely volcano is represented by suite of compositions ranging from basalt to rhyolite. Second, Young Gorely edifice is composed of only basalt, andesite and dacite. The reconstruction of chemical evolution trends shows that both volcanic series of Gorely volcano share the same genetic history with similar evolutionary stages. We suggest fractionation of an upper mantle peridotite as common means to produce both volcanic series as a result of which the evolution of all rocks was generated. The magmatic series of Pra-Gorely and Young Gorely volcanoes were formed under different geodynamic conditions. Between these two series was a powerful stage of caldera formation, during which 100 km3 of ignimbrites were emplaced. The 12-km diameter caldera collapse was the catalyst for large-scale reorganization of the volcanic feeding system. Nevertheless following caldera collapse, Young Gorely volcano was formed by activity inside the caldera and shows very similar evolutionary trends to that of Pra-Gorely volcano. It can be confidently stated that crustal components are practically absent in the evolution of the series, and the compositional range is attributed directly to the evolution of the magmatic melts of Gorely volcano. Microprobe analyses conducted on olivine and pyroxene phenocrysts of Gorely volcano lavas, show that there were at least two stages of crystallization during the evolution of magmatic melt. The two-stage character of initial magmatic melt evolution is confirmed by computer simulation results. The existing of this stage of crystallization testifies to shallow magmatic chamber presence which is responsible for generation of caldera and thick ignimbrite complex.

1.1-P-62

Magma Degassing during 7600^{14}C Kurile Lake Caldera-Forming Eruption and its Climatic Impact

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Kurile Lake (Southern Kamchatka) was formed by caldera-forming eruption ~7600 y.a. (Ponomareva et al., 2004). Total tephra volume conservatively estimated of 140–170 km^3 (70-80 km^3 DRE) was dispersed over an area of >2 mln. km^2 (Ponomareva et al., 2004). The main goal of this study was estimation of volatile components volume injected into the atmosphere during Kurile Lake (KO) eruption and its possible climatic impact. The volatile content in magma before the eruption was estimated by direct measurements of H_2O, S, Cl and F contents in natural quenched glassy melt inclusions trapped by plagioclase phenocrysts. The volatile content in rocks after the eruption was estimated by analyses of matrix glasses in tephra. The amount of S injected into the stratosphere during KO eruption was about 2 times more than after eruptions of Krakatau (1883), Katmai (1910) and Mount Pinatubo (1991). Similar amounts of S degassing were defined for eruptions

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