V11B-07 0935h

Growth and Collapse of Reunion Island

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Rising above a seafloor of Paleocene age, the Reunion oceanic volcanic system is a flattened cone having a basal diameter of 200 to 240 km and height of about 7000 m. The island. has a diameter of 50 to 70 km and reaches 3000 m in height. The dormant Piton des Neiges and the highly active Piton de la Fournaise volcanoes constitute the island, which represents only a small percentage, about 3%, of the volume of the whole system. Bathymetric and sonar surveys of the submarine flanks, as well as gravity, magnetic and seismic surveys inland and offshore, permit to image part of the remaining 97%. Gravity data show the presence of 2 large and deeply rooted dense bodies beneath the center of Piton des Neiges and the eastern coast. These bodies are hypovolcanic complexes that formed during the growth of Piton des Neiges and that of an other, now concealed, main volcanic focus named Les Alizés. The young Piton de la Fournaise volcano has not yet developed a large, dense hypovolcanic complex. The relationship between these large dense bodies and depressions at the surface is being investigated. Available high-precision bathymetric and sonar images of the submarine flanks show that products resulting from flank collapses are present virtually all around the island. At least 15 individual units can be recognized on the surface of the submarine flanks. The dimensions of most units imply large source areas on land. The most recent landslide events that affected Piton de la Fournaise and their source areas on land are well defined. This is not the case for older landslides. On the basis of topographic features and available geological data we have attempted to locate their most probable sources areas. We conclude that the headwalls of several huge landslides intersect in the central area of Piton des Neiges. A unique case of collapse is that of the central area of Piton de la Fournaise. We propose a mechanism of passive collapse of this area in response to the lateral collapse of eastern flank of the edifice.

V11C MCC: Level 1 Monday 0830h

Volcanic Emissions to the Troposphere: Posters I *(joint with A, B)*

Presiding: **R J Andres,** University of North Dakota**; I M Watson,** Michigan Technological University

V11C-0504 0830h POSTER

The Volcanic Contribution to the Global Atmospheric Mercury Cycle

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Mercury is a highly volatile, bioaccumulating toxic trace metal with a long (ca. 1 year) atmospheric residence time. Mercury is strongly enriched in volcanic emanations, where it exists as gaseous elemental or reactive Hg, as well as particulate Hg. Volcanoes are the only natural sources of direct Hg emission to the free troposphere and stratosphere, and the principal natural sources of reactive and particulate mercury. The other natural sources (surface water and soil emissions) predominantly release gaseous elemental mercury to the atmospheric boundary layer. The paucity of relevant volcanic plume data means that there is considerable uncertainty over the annual emission rate of mercury from volcanoes. Previous estimates span three orders of magnitude (∼1-1000 Mg Hg/yr), or from 1% to ∼50% of total natural Hg emissions. Critical assessment of the literature reveals strong evidence for the important role of volcanoes in the global mercury cycle. Using data from active volcanoes and natural ice-core and peat-bog archives, we estimate that the time-averaged volcanic Hg emission rate is ∼700 Mg/yr, or 20-40% of total natural emissions. Year-on-year release of Hg from continuously erupting and degassing volcanoes is ∼75 Mg/yr, or only about 10% of this time-averaged flux. 75% of volcanic Hg is released during 'smaller' sporadic eruptions (<10-100 Mg Hg/event). Several individual explosive eruptions per century will be large enough (>1000 Mg Hg) to overwhelm the total atmospheric burden, with subsequent deposition rates rivalling anthropogenic maxima. Large eruptions account for about 15% of total volcanic Hg emissions, and the records of past emissions will be preserved in ice core and peat bog archives. Previous 'low' global volcanic flux estimates (<50 Mg/yr) were based on inappropriate extrapolation of data from low-temperature fumaroles at non-erupting volcanoes to the high-temperature emissions from active volcanoes. Considerable work remains to be done to define the Hg:S ratios in high temperature volcanic emissions. Individual persistently active volcanoes (e.g. Etna, Sicily) may act as important local point sources of mercury emission to the atmosphere, and their contribution to regional emissions inventories should not be neglected.

V11C-0505 0830h POSTER

Volcanic Gas Emissions Through History and Geography

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The total gaseous output of a volcano is in most cases closely related to its actual phase of activity. A volcano undergoes different stages of activity during its "life-time". For estimating the gas input into the atmosphere from ancient volcanoes these activity stages have to be considered very intensely. We considered the global distribution of 360 subaerial active volcanoes that erupted at least once during the past 100 years. A significant feature is the high concentration of active volcanoes along the subduction zone of the Circumpacific Ring of Fire. Volcanoes related to subduction zones are the major gas-emitters because of the large number of very active and highly explosive volcanoes. More than 300 of the 360 active subaerial volcanoes are related to subduction zones, 24 to rift zones and 22 to ocean islands. There is no tendency for volcanoes of a certain tectonic setting to be located at a specific latitude. We summarized altitudes of 360 volcanoes and determined their altitudinal range for each tectonic setting. Volcanoes of the three main tectonic settings show average heights between 1-3km: a) subduction zones: 2-3km, b) rift zones: 1-3km, and c) ocean islands: 1.5-2.5km. Active volcanoes cluster in the equatorial latitudes (0° to 30°) on both hemispheres with volcanoes in the southern hemisphere reaching heights of over 6000m a.s.l. Thus, most eruptions (30 eruptions/a) occurred at equatorial latitudes (0° - 30°). In general, the number of volcanoes located in the northern exceeds those in the southern hemisphere by 3:1. We assume a higher SO2 input into the northern hemisphere. But we found also a relatively high volcanic SO2 output in the southern hemisphere, which may be caused by higher magma supply rates. The increased frequency of eruptions in the southern hemisphere in the equatorial latitudes could be partly caused by shorter intervals between eruptions (Takada, 1999). Volcanoes between 50°-60° N showed also a relatively high annual number of eruptions (7 eruptions/a). Volcanoes at polar latitudes 60°-90° are contributing 3 eruptions/a, because only 16 out of the 360 active subaerial volcanoes are located at high latitudes. Forteen volcanoes are located at 60°-90°N and two between 60°-90°S. In summary, 54 eruptions/a are injecting gas into the atmosphere. Ref.: Takada A (1999) Variations in magma supply and magma partitioning: the role of tectonic settings. J Volcanol Geotherm Res 93: 93-110

URL: http://www.univie.ac.at/Mineralogie/martina

V11C-0506 0830h POSTER

An Updated Time-Averaged Inventory of Subaerial Volcanic Sulfur Emissions

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An updated time-averaged inventory of subaerial volcanic sulfur emissions to the atmosphere is presented. This work builds upon an inventory previously compiled by Andres and Kasgnoc (1998, JGR 103:25,251-25,261), which covered a time period from the early 1970s to the mid 1990s. The updated inventory extends to the end of 2002. Data contained within the inventory consist primarily of sulfur dioxide measurements taken at volcanoes, listed as a time-averaged flux in Mg/d. This inventory may provide input to global sulfur and sulfate models, inventories of other volcanic species compiled by the species:sulfur ratio, and volcano-atmosphere interaction models. This work also contributes to the Global Emissions Inventory Activity (GEIA), whose goal is to create, maintain, and distribute reliable inventories of species important for understanding global atmospheric chemistry at a one-degree global scale.

URL: http://www.geiacenter.org/

V11C-0507 0830h POSTER

A Satellite-Derived Global Inventory of Volcanic Thermal Emissions Into the Atmosphere

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During the last decade an average of 60 volcanoes erupted each year, around 20 of which were erupting on any given day. Some of these, such as Erta Ale in Ethiopia, are persistently active, whereas others, such as Bezymianny in Russia, erupt more sporadically. Satellite remote sensing offers a convenient way to monitor changes in the thermal budgets of these volcanoes from space, in addition to quantifying the contribution active volcanism makes to the Earth's energy budget. Using data provided by the HIGP MODVOLC algorithm we show how the amount of heat radiated into the Earth's atmosphere by more than 50 active volcanoes has varied during 2001, 2002, and 2003. In 2001, the total amount of heat radiated into the Earth's atmosphere from these volcanoes was 5.3×10^{16} J year^{-1}, with the total amount of heat energy perhaps as much as 9×10^{16} J year^{-1} when heat loss by convection is taken into account. This is three orders of magnitude less that the amount of energy consumed (and, ultimately liberated into the atmosphere) by the United States of America in 1999, as a result of manufacturing, transportation and residential activities. From the geographic perspective of the authors, the amount of energy released into the atmosphere by Kilauea volcano during 2001 (2.3×10^{16} J year^{-1}) was approximately equal to the amount consumed by the State of Hawai'i for residential purposes.

URL: http://modis.higp.hawaii.edu

V11C-0508 0830h POSTER

Phosphorus-bearing Aerosol Particles From Volcanic Plumes

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Particles rich in P or bulk geochemical data of volcanic aerosol particles showing high P contents are known from many volcanic plumes (Stanton, 1994; Obenholzner et al., 2003). FESEM/EDS analysis of individual particles obtained from the passively degassing plume of Popocatepetl volcano, Mx. (1997) and from the plume of Stromboli (May 2003) show P frequently. Even at the high resolution of the FESEM, euhedral apatite crystals could not be observed. At Popocatepetl (1997) spherical Ca-P-O particles are common. Fluffy, fractal or botryoidal particles also can contain EDS-detectable amounts of P. The EDS spectrum of such particles can comprise various elements. However most particles show P, S and Cl. P-S and P-S-metal species are known in chemistry but do they occur in volcanic plumes? Stoichiometric considerations had been made in the past suggesting the existence of P-S species in plumes (Stanton 1994), gas sampling and remote gas monitoring systems have not detected yet such molecules in plumes. The particle spectrum of the reawakened Popocateptel volcano might be related to accumulation of volatiles at the top of a magma chamber during the phase of dormancy. P-Fe rich, Ca-free

aggregates are also known from the eruption of El Chichon 1982 (SEM/EDS by M. Sheridan, per. comm. 08-24-2003). Persistently active volcanoes (i.e. Stromboli) represent a different category according to continuous degassing and aerosol particle formation. A particle collector (ca. 1 l/min) accompanied a COSPEC helicopter flight at Stromboli (May 15, 2003) after one of the rare types of sub-plinian events on April 5 2003. P-bearing particles are very common. For instance, an Fe oxide grain (diam. = 2 m) is partially covered by fluffy and euhedral P-bearing matter. The elements detected are P, Cl, Na, Mg, Al, Si, K, Ca, Ti and (Fe). The fluffy and the euhedral (rhombohedral?) matter show in SE(i)-SE(e)-mix image almost identical grey colors. At Stromboli and Popocatepetl particles on which Mg chlorides are present had been detected. Mg and P are major elements of magmas and are not considered to be highly volatile. Can such particles of probably volcanic origin be the source for easy soluble P necessary for the crystallization of P-bearing bio-minerals, i.e. in teeth of Mammalia, phosphorite concretions within kidneys of certain bivalves, the digestive glands of gastropods and crustaceans (Gooday et al., 1995), the formation of DNA, ATP or ADP of living organisms? The solubility of naturally occurring apatite cannot support the needs of P to the biomass (Cox 1995) , even if P from apatite accumulates throughout Earth's history a process provided by the food chain. P is number 10 of the naturally occurring elements of the upper continental crust (665 ppm; Wedepohl, 1995). It remains unknown: what is the influence of a polluted atmosphere to the formation of analyzed particles. Cox, P.A., 1995. Oxford University Press. Gooday et al., 199.5 J. mar. Biol. Ass. U.K., 75, 469-481. Obenholzner, J.H., et al., 2003. In Volcanic Degassing (Oppenheimer, Pyle, Barclay eds.). Geol. Soc., London Stanton, R.L., 1994. Clarendon Press - Oxford. Wedepohl, K.H., 1995. Geochim. Cosmochim. Acta, 59, 7, 1217-1232.

V11C-0509 0830h POSTER

Observing Popocatepetl's Volcanic Clouds Using MODIS Infrared Data

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Popocatepetl Volcano, Mexico, is a tropical volcano with significant and persistent emissions of SO_2 and ash. These emissions pose significant hazards to the large population in close proximity to the volcano and are an important indicator of eruptive activity (Love et al., 1998, Nature 396: 563-566). Moderate Resolution Imaging Spectroradiometer (MODIS) satellite imagery provides us with a synoptic perspective of volcanic emissions and atmospheric interactions, information unavailable from ground-based or aircraft studies, which can be useful for hazard mitigation. We report on MODIS data during December 2000 and January 2001 coincident with abundant emissions based on COSPEC data. SO_2 masses are retrieved using the 7.3 μm and 8.6 μm absorption features of SO_2 (7.3 μm method after Prata et al, in press, AGU Volcanism Atmospheric Monograph; 8.6 μm method after Realmuto et al, 1997, J. Geophys Res 102: 15057-15072). Ash masses are retrieved using silicate absorption features at 11 μm and 12 μm (Wen & Rose, 1994, J Geophys Res 99: 5421-5431). Furthermore, this data set tests the accuracy of the algorithms and the conditions under which the algorithms work best, and can be compared to COSPEC measurements taken by Popocatepetl's monitoring team. We found that MODIS data often showed more than one volcanic cloud. For example, one MODIS image collected January 23rd, 2001, at 0450 UT, shows four large eruptions that have dispersed volcanic clouds over an extensive area of Mexico. Using upper air data and monitoring records, the movements of the 4 ash clouds are fit with eruption times and winds, and using retrieval data for SO_2 and ash we can derive a time based SO_2 and fine ash emission record. The results of these retrievals compliment ground-based measurements which cannot measure large scale eruptions.

V11C-0510 0830h POSTER

Detection and Fate of the August 18 and 28, 2000 Eruption Clouds of Miyakejima, Japan: An Analysis Using TOMS, MODIS, AVHRR, GMS, and ASTER

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Volcanic eruptions eject ash, sulfur dioxide, and other gases into the atmosphere. These volcanic products create a variety of hazards, including health and aviation hazards and changes in climate. Some of the major questions regarding the mitigation of these hazards include: the mass, extent, and height of the cloud, how long it takes for SO_2 to convert to sulfuric acid, and how long aerosols remain in the atmosphere. Remote sensing techniques allow: long-term tracking of volcanic clouds because data are acquired on a regular basis, analysis of eruptions in isolated areas, and measurements of an entire eruption cloud. New techniques for retrievals have been developed and new sensors have been launched, however, there has been no systematic comparison to understand the capabilities of the sensors under varying environmental and volcanological conditions. In this case study of Miyakejima, Japan, data from five different satellite sensors are compared and used to produce constraints on the masses and distributions of ash, SO_2, and aerosols released by the August 18 and 28, 2000 eruptions. Satellite data include: 6 TOMS, 6 MODIS, 11 AVHRR, and 2 ASTER images, as well as 8 days of hourly GMS images. Preliminary results, comparing TOMS and MODIS, show the August 18 ash and gas cloud drifting south. Retrievals using the two sensors suggest an ash mass of at least 26 kilotonnes (kt). The August 28 eruption cloud drifted to the northeast and contained approximately 11 kt of SO_2.

V11C-0511 0830h POSTER

Temperature anomalies in the plumes of the August, 18 and August, 29, 2000 eruptions of Miyake Jima volcano (Japan) inferred from delays of GPS waves crossing them.

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Using the GAMIT software we processed seventy days of GPS data (30s sampling rate) collected by the GSI at four sites on Miyake Jima volcanic island (Japan) between June 27, 2000 and September 5, 2000. This period includes a large seismic swarm (June 27, 2000 - July 8, 2000) followed by several major paroxysms at the volcano crater (July 9, 10, 14, 15, August 29) producing a 1 km wide caldera. The medium term velocity of the stations coordinates, already published elsewhere, is maximum during the seismic swarm and corresponds to a large dyke intrusion mostly offshore west of the volcano. No anomalies are observed in the time series of the daily GPS coordinates for the days of the paroxysms. An epoch by epoch processing of those days, using a kinematic software shows that there is no deformation during the paroxysms themselves. We then examined epoch by epoch the path delay residuals of the GPS phases at each GPS station during the events. Those delays exceed 200 mm in some cases. As they cannot be explained by a temporal change of the stations coordinates, we conclude that the cause of these delays is the presence of the hot volcanic plume not modeled by the GPS data processing which assumes a homogenous troposphere. We used a classical seismic tomography algorithm (modified to handle 3D + time) to map the path delay anomaly in the plume as a function of time. We interpret the anomalous delays as temperature anomalies in the plume, assuming a normal pressure and a plume saturated in humidity. The maximum average temperature anomaly is 20°, a low value compared to what is currently proposed in the literature. Higher temperature should exist in the inner part of the plume, but the horizontal extension of this hot zone cannot be more than 50-100 m, otherwise the GPS data would detect it.

V11C-0512 0830h POSTER

H2O Emission Rate of Volcanic Plume During the 2000-2002 Miyakejima Volcanic Activity

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After the onset of the 2000 eruption, Miyakejima has effused a large amount of volcanic gases from its summit crater. We have observed the volcanic plume and estimated H2O emission rate from the summit crater, using infrared thermal images of the plume and meteorological data, such as air-temperature, humidity and atmospheric pressure (Matsushima and Nishi, 2001). The infrared thermal images provide the plume upward velocity, cross section and mean temperature at arbitrary heights. The plume is modeled as the mixture of volcanic gas and entrained atmosphere. Mass and energy conservation equations are derived from the plume model. Substituting the observed values and the physical constants into the equations, we calculate the emission rate of H2O discharging from the vent. The mean values and standard deviations of plume temperature, cross section and upward velocity are evaluated for the continuous data recorded for 300 sec on 19 September 2000. From the data fluctuations and sensitivity tests, the error of H2O emission rate is estimated to be about 30 %. The H2O emission rate showed the highest value of 1,000 kton/day in September 2000, and then it decreased gradually to 100 kton/day with large fluctuations as of June 2002. The variation is similar with that of SO2 emission rate (Kazahaya et al. 2001) except for the high value in September 2000. The average H2O/SO2 wt ratio is about 10, which corresponds to the melt gas content analyzed from the glass inclusion (Saito et al., 2001). The rapid decrease of H2O emission rate from September to October suggests that the ground water had progressively evaporated by the heat of uprising volcanic gas. The constant H2O/SO2 wt ratio after October 2000 means that the ground water is dried up or expelled from the conduit and the plume is mainly composed of volcanic gases. This interpretation is confirmed by mathematical simulation. The simulation accounts for multiphase mass and heat transport within a porous medium, and the supply of superheated vapor from degassing magma. Considering the fitting between the simulated H2O emission rate and the observation, practical hydrothermal conditions within the conduit and surrounding rocks are investigated.

V11C-0513 0830h POSTER

Initial Field Trials for Development of RMDI, a Miniaturized UV/Visible Spectrometer Designed for Multi-gas Remote Sensing of Volcanic Plumes

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This is a preliminary report of multi-gas measurements of SO2 and NO2 with a miniaturized UV spectrometer. The RMDI (Resonance Mini-DOAS I) is a miniaturized zenith or slant-viewing, charge-coupled device (CCD) spectrometer. For the field trials, the RMDI operates in the 295 to 437 nm region with a spectral resolution of 0.4 nm and a field of view of 2 degrees. The instrument employs an Ocean Optics USB2000 spectrometer with the addition of a UV objective, multi-cell calibration system, visible blocking filter, palmtop computer (also serving as the power source), and miniature tripod with manual and motorized scanning. The entire package weighs less than 3.5 kg. Field trials at Tarumae volcano, Japan (July 05, 2003) measured 25.9 Mg/d (tonnes per day) of SO2 by doing walking traverses under the small volcanic plume. The results were calculated using three separate wavelengths for SO2 (310, 312, 315 nm) and all three results were found to be consistent with each other. Trials at a coal-fired power plant (Southwest Power Plant,

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Springfield, MO, USA, August 28, 2003) were able to obtain SO2 and NO2 readings of 9.8 and 0.72 Mg/d, respectively. The NO2 measurement was based on the spectra wavelength range of 411 to 415 nm. Laboratory and field testing is planned to further evaluate the precision, accuracy and applications of this type of instrument for remote sensing of volcanic plumes and to evaluate its performance relative to the correlation spectrometer (COSPEC), the accepted standard for volcanic SO2 measurements.

V11C-0514 0830h POSTER

Probing Volcanic Eruption Clouds With the Airs Spectrometer on Aqua: A New Tool for Quantifying Sulfur Dioxide and Ash Emissions

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Since its launch on EOS/Aqua in May 2002, the Atmospheric Infrared Sounder (AIRS) has successfully detected SO_2 and ash clouds emitted during a number of volcanic eruptions. Detection of SO_2 is achieved using the strong infrared absorption band of the gas centered around 7.3 μm. For upper tropospheric volcanic clouds, preliminary AIRS SO_2 retrievals performed using a version of the AIRS radiative transfer algorithm that includes variable SO_2 indicate good agreement with SO_2 amounts detected by the ultraviolet Total Ozone Mapping Spectrometer (TOMS) where coincident data are available. However, the higher spatial, spectral and temporal resolution of AIRS provides much improved coverage of volcanic emissions at lower altitudes, such as the October 2002 eruption of Mt.Etna (Italy). AIRS retrievals of SO_2 and ash optical depths and effective particle radii in volcanic clouds from several eruptions will be presented, including Etna, Ruang (Indonesia, September 2002), Reventador (Ecuador, November 2002), Anatahan (Mariana Islands, May 2003) and Soufriere Hills (Montserrat, July 2003). These examples demonstrate the potential of AIRS data to improve measurements of volcanic SO_2 and ash loading following eruptions, and to refine our understanding of volcanic cloud composition,structure and evolution.

V11C-0515 0830h POSTER

Coupling a Lagrangian Dispersion Model and Remote Sensing Data for Quantification of Volcanic Ash Transport and Deposition

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Use of remote sensing techniques, particularly the band 4 (10.3-11.3 μm) minus band 5 (11.5-12.5 μm) "split-window", is the predominant method for monitoring the long-term movement of airborne volcanic emissions such as ash, water vapor, and other gases. The split-window technique works well for moderately concentrated clouds, and there are methods based on radiative transfer that may provide quantitative information about total mass and particle size (Wen and Rose, 1994). However atmospheric dispersion, sedimentation and wet deposition eventually lead to the loss of discernible signals in the split window. Fortunately, numerical dispersion models do not have a low-concentration limit and are capable of longer term tracking. Model simulations also provide relative concentration changes with time. Only after post-event analysis is it possible to obtain quantitative concentration information as a function of space and time. A new technique combining remote sensing data with model simulations which may help provide near real-time information of cloud concentrations has been developed. This technique uses information gathered from several relatively recent eruptions for which total eruption volume and fallout distributions have been determined. Using the fallout distribution measurements and model simulations, the deposition rates at a function of location and time can be calculated. Combining this information with net eruption volume, ash cloud concentrations can be quantified from the model simulations and further correlated with the remote sensing data. The low-concentration limit of the split-window technique can then be obtained. Using this information, cloud concentrations can be obtained from model simulations for cases when concentration levels are too low or remote sensing data is simply not available. Although the required data for this technique is somewhat scare, initial results are encouraging and will be discussed. The results from this technique will be compared with those based on radiative transfer models. Also, some of the new numerical modeling techniques implemented to provide more precise information about deposition rates will be presented.

V11C-0516 0830h POSTER

Correlation of SO_2 Gas Emissions, Seismicity and Thermal Signals at Santiaguito, Guatemala

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With vertical explosions occurring approximately every 40-50 minutes, the Santiaguito dome at Santa Maria Volcano is an ideal system for examining short-term data patterns. A 3-week long field experiment was performed in January 2003 at the Santiaguito Volcano Observatory in order to record high temporal resolution measurements of volcanic activity. We collected digital seismic data from a single vertical component seismometer located approximately 4 km southeast of the active Caliente vent. A portable infrared thermal monitoring unit was deployed daily to record the temperature of the plume as it left the vent at an acquisition rate of 300 measurements per minute. A miniature ultraviolet spectrometer (MUSE) was also deployed daily to measure the SO_2 gas emissions just above the vent. This instrument is based on the differential optical absorption spectroscopy (DOAS) technique and allowed for continuous readings at a rate of 36 measurements per minute from approximately 6.5 km south of the Caliente vent. At abstract time, the seismic data is not analyzed, but there is a strong correlation between the SO_2 emission and thermal data showing that the expulsed gas heats the dome extensively as it is emitted, with a possibility of different signatures indicating certain types of activity such as pyroclastic flows. It is expected that, with the addition of seismic data and the application of analysis of periodicity using Fourier Transforms, the data will elucidate conduit processes, providing additional vital constraints to sub-surface models.

V11C-0517 0830h POSTER

Photometric Observations of Aerosol Plumes From Volcanoes in Guatemala, El Salvador, and Nicaragua

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Visible to near infrared sun-photometers were used to measure spectral optical depths in order to infer particle size distributions of volcanic aerosols in plumes from volcanoes in the Central American arc. Data were taken from the following volcanoes on the listed dates in 2002: Pacaya, Guatemala on January 14, 16, 20 and 21; Santa Ana, El Salvador on January 24 and 26; San Miguel, El Salvador on January 28; and San Cristobal, Nicaragua on February 3. These volcanoes were chosen for study because of: good calibration of the sun-photometer (Pacaya), the presence (and effects) of a crater lake (Santa Ana) and a paucity of previous measurements (San Miguel and San Cristobal). The optical properties of these tropospheric volcanic aerosols will be retrieved after the removal of the background optical depth. Through the application of the Angstrom equation and a King-type inversion, the Angstrom coefficients, the particle size distribution, and the effective radius (Reff) will be determined (Watson and Oppenheimer, 2000; 2001). Through these methods we hope to increase the understanding of emission and conversion processes of tropospheric volcanic aerosols. We hope the interpretation of these data will help elucidate environmental and climatic effects of these aerosols on local to global scales, and provide insight into modulation of aerosol emissions through the presence of a crater lake.

V11C-0518 0830h POSTER

SO_2 loss rates at Lascar volcano, Chile: preliminary results and interpretations from 2002 measurements

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The measurement of volcanic SO_2 emission rates is commonly performed on cross sections of the plume some distance downwind from the active vent, some time after its interaction with other volcanogenic gases (primarily water), particles and droplets of volcanogenic and/or meteoric origin, and atmospheric gases. The emission rates being measured therefore do not necessarily represent the real fluxes emitted by the volcano; instead they are underestimated due to the conversion of SO_2 to $SO_4{}^{-2}$ (Oppenheimer et al., 1998). Near source plume chemistry is not well understood, but can have significant effects on climatologically active species, which is why it is important to quantify volcanic SO_2 conversion rates as a function of meteorological environment and plume age. A mini-UV spectrometer and a Microtops II sun photometer were used to measure SO_2 emission rates and aerosol particle size distributions at Lascar volcano, Central Andes, during the months of October and November 2002. Direct gas measurements from fumaroles in the crater were made on November 1. These represent the first gas samples ever collected directly in the crater. Lascar volcano represents one of the end-members of the environmental spectrum, being a high volcano (summit altitude at >5600 meters above sea level) in a dry atmosphere (average RH<15%). Its location allows for simultaneous near-vent and downwind measurements at similar altitudes. Here we present our preliminary results from November 2, 2002, taken at a variety of azimuthal angles (effective distances from the plume) from the vent downwind to about 20 km, during a two-hour period (0900-1100 local time). This represents a time downwind of up to ~42 minutes, based on a plume speed of ~8 m/sec. Initial interpretations and correlations with the direct measurements are also presented. The data obtained from a Kestrel 4000 weather station will help clarify the effects of Lascar's high, dry, and extremely transmissive atmosphere upon SO_2 conversion rates.

V11D MCC: Level 1 Monday 0830h

State of the Art in Theory of Materials: Methods and Applications I Posters *(joint with P, MR, DI)*

Presiding: **B Winkler,** Institut für Mineralogie, Abt. Kristallographie, Johann Wolfgang Goethe-Universitat**; B Kiefer,** New Mexico State University

V11D-0519 0830h POSTER

Influence of water on the compressional mechanism of β and γ spinels

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