Caldera Subsidence Measurement at Miyakejima Summit

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Miyakejima volcano began its eruption at June 2000. We quantitatively measured expansion of caldera subsidence, which appeared on 8 July, with temporal series of DTMs created from digital photogrammetry, SAR interferometry and airborne laser scanning. It was found that the subsidence speed until early August was 15 million m^3 per day on average. The subsidence seemed to nearly stop on mid August in its volume but the caldera area is still increasing as of October 2000. We made ortho images for geographical investigation. There were water-covered areas in the caldera. We could recognize marks of lahar, talus and detritus.

key words: Miyakejima, caldera, subsidence, DTM, volcano

Morphological changes following the 1982 eruption of El Chichón volcano, Mexico

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The 1982 El Chichón volcanic eruption was the largest recorded eruption in México in historical times and one of the largest eruptions in the world in the XX century. Erosion and sedimentation processes and morphological changes in the El Chichón cone and adjacent areas were monitored yearly for 17 years following the eruption, by field photographs, mapping and measurements. Climate is tropical and wet, with rains throughout the year. After the eruption a new 1- km diameter crater was formed, and 8- km long pyroclastic flows covered the volcano slopes and destroyed several villages and all the forest cover. By 1999 almost all of the affected areas had been completely revegetated. High magnitude accelerated erosion occurred mainly during the first years after the eruption and decreased by several orders of magnitude during the following years. The aims of this study were: (a) to analyze erosion and sedimentation processes in the volcano and adjacent areas; (b) to identify revegetation processes, rates of erosion, and the morphological development of the affected areas following the eruption.

Key words: Chichon volcano, volcanic landforms, erosion processes, recovery rates

Geomorphological Evolution of the Boyong Valley Following the 1994 eruption of Merapi Volcano, Central Java, Indonesia

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Mount Merapi (2965 m) is a stratovolcano located in the highly populated area of Central Java. On 1994, November 22nd, gravity-driven dome-collapse pyroclastic flows channeled as far as 7 km from the summit, killing 69 people. Following this eruption, rain-triggered lahars drastically modified the previous morphology of the Boyong channel. The riverbed gradient was reduced from 5.1 to 3.8% upstream from the checkdam BOD6. Three main hydro-geomorphological segments were distinguishable, based on the mechanisms of erosion and sedimentation: (1) a proximal segment, related to the pyroclastic source deposits, which were downcut in excess of 12 m during the first year following the eruption; (2) A medial segment, hundreds of meters downstream from the pyroclastic deposits, is related to an unsteady transitional zone, where erosional processes alternate with depositional processes; (3) A distal segment, immediately upstream from the dams, is characterized by a continuous depositional process.

Key Words: lahar, geomorphological evolution, erosion, Merapi volcano, Java island.

Dr. Jean-Claude THOURET
ABSTRACT 1
Session 6 Volcanic geomorphology or X global geomorphology
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Valley History and Ignimbrites in the Central Andes of Southern Peru

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In the area of Arequipa, ignimbrites 13-14 Ma outcrop above the base of the Río Chili valley that cuts the flank of the Western Cordillera. The Rio Chili valley has been filled in part only by lava flows and volcaniclastics of Plio-Quaternary age. Downcutting has been achieved within the past 3 My, but ignimbrite 2-3 Ma old that flowed from an area now beneath the Chachani massif has been cut <200 m down only. In contrast, the headvalleys of the deepest canyons on Earth (Ríos Cotahuasi and Colca, NW of Arequipa) have been cut 3 km down in Miocene volcanic rocks and were intermittently refilled by pyroclastics and lava flows. These canyons, deeper and older than that of Rio Chili, probably date back to the middle Miocene. More than half of the uplift of the Western Cordillera postdates the emplacement of the middle Miocene ignimbrites, but as little as 25% of downcutting of the canyons occurred since the climatic change toward aridity around 10 My. Downcutting of these canyons triggered flank failures on the Plio-Quaternary stratovolcanoes and subsequent debris avalanches; landslides involved the Miocene ignimbrites that form the canyon walls cut in the high plateaus.
Key words : Andes, Peru, ignimbrites, volcanoes, uplift, valley downcutting.

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5th International Conference on Geomorphology

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August 2001, Chuo University (Tokyo, Japan)

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Evolution of Stratovolcanoes in the World

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I generalized the evolution of the Quaternary stratovolcanoes in Japan. All of them have been evolved through only one course of development. Their landform, structures, eruption styles, kinds of eruptive products, mineral and chemical compositions, eruption periods etc. of the stratovolcanoes have changed in evolution. In this paper I will discuss evolution of the stratovolcanoes in the world in comparison with those in Japan. In the High Cascades St. Helens volcano have evolved in a course from a rhyolitic lava dome cluster to basalt-andesitic lava flows and scoria (Taylor, Malinche volcanoes etc.). Shasta, Newberry, Three Sisters, Medicine Lake Highland volcanoes etc. could have evolved in the similar course to that of St.Helens volcano. The evolution suggests that at first lower crust-fusion magmas and the next mantle-origin magmas rise up. Vico, Albano, Roccammonfina, Vesuvius and Vulsini high-K-magma volcanoes are very similar to the later-stage volcanoes in Japan in the landforms and evolutions. But the volume of pyroclastic flow deposits are much larger quantity than those in Japan. The origins of such facts different from those of the volcanoes in Japan will be discussed.

Key words: stratovolcano, landform, evolution, Quaternary

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Structure and structural control of the activity of Mount Cameroon

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Located on the continental margin, at the north-eastern corner of the Gulf of Guinea, Mount Cameroon is an active volcano-tectonic complex, formed at the intersection zone of some of the main faults which generated the opening of the Atlantic Ocean. Built up by combined volcanic and tectonic activities, its morphostructure is characterised by a SE-NW succession of more or less uplifted or sunk panels, with a symmetric geographical distribution on both sides of the volcano's central axis. Almost all the volcano's manifestations are controlled by the tectonic structure.
With an average of two events every three days, mainly distributed along large extension fractures zones, (Bokosso, Tiko and Limbe faults), earthquakes come both under volcano-tectonic activity of the mountain and the relative instability of the continental margin between Luanda (Angola) and Conakry (Guinea).
The volcanic active zone, with more than 350 parasitic cones and 7 eruptions since 1909, extends along the central axis fault system and its 4 main radial extensions on the south-western and north-eastern slopes of the mountain.
The hydrothermal manifestations are concentrated on the upper plateaux, with hot zones and hundreds of fumaroles vents distributed along opened fissures.
Key words: tectonic movement, structural control, volcanic activity, earthquakes.

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Eruption- and Earthquake-Induced Catastrophic Mass Movements in Japan

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In tectonically active zones, including the Japanese Islands, catastrophic mass movements often occur by direct or indirect effects of volcanic activities and earthquakes. Historical events occurred on Japanese volcanoes include: Unzen-Mayuyama, Kyushu (1792), Bandaisan, Tohoku (1888), Tokachidake, Hokkaido (1926), and Ontakesan, Chubu (1984). Each of these events yielded a huge amount of sediments on the order of 10^7 m^3 or more. In the case of Tokachidake, melting of snow by pyroclastic flows triggered torrential mudflows. During the 1991-94 eruption of Unzen-Fugendake, frequent pyroclastic flows were followed by a series of rain-triggered debris flows, with the total volume of sediments exceeding 10^8 m^3. On active volcanoes, the minimum amount of rainfall triggering large-scale debris flows is generally small, 10-15 mm/hour intensity and 20-30 mm for continuous rainfall. This is due to ash cover reducing the permeability of the land surface, and high erodibility and/or instability of newly deposited ejecta and lava boulders. Mention is also made of the effects of earthquake-induced large-scale landslides and debris flows.
Key words: volcano, eruption, earthquake, catastrophic mass movement, rapid erosion

OK

Geoarchaeological Studies at Two Pliocene Stratovolcanoes in Bolivia

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A study on the origin of Chullpas, or grave towers, was carried out in a Tertiary-Quaternary volcanic province which is located on the northern side of the saline lake basin of Salar de Coipasa in Bolivia. The grave towers were built by the indigenous Aymaras and are pre-Columbian in age. Two Pliocene stratovolcanoes are located in the study area. They are surrounded by an extensive plain that is covered by alluvial and aeolian sands. Erosional gullies have developed on the cones by ephemeral streams and mass wasting. Each gully terminate at the foot of the mountain in an alluvial fan. Deposits of calcareous sand, the principal building material of the grave towers, are found in the distal part of each alluvial fan. It is suggested that these calcareous deposits are related to ground-water flow from the mountain. The surrounding plain is dry and evapotranspiration will cause capillary rise and, consequently, evaporation causes saturation with respect of calcium. Similar sequences of epiclastic sediment (alluvium and colluvium) and calcareous sand could be found at other volcanoes that are situated in continental deserts. These deposits may be important environmental indicators in ancient volcanic successions.