# A review of recent researches on volcanic debris avalanche

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Volcanic debris avalanche, initiated by sector collapse of a volcano, is large-scale and high velocity gravity current and causes large impacts on foot of a volcano. Evaluation of debris avalanche is one of the important factors to mitigate the volcanic disasters. Recent researches on volcanic debris avalanche are reviewed and future plans are summarized in this paper.

Recent researches on debris avalanches using remote sensing are developed recently. Such as, Landsat Thematic Mapper observations of debris avalanche in Central Andes (Francis and Wells, 1998), SPOT and Radar image analysis at Central America debris avalanches (Kerle and van Wyk de Varis, 2001), mapping hydrothermally altered rocks on Mount Rainier with AVIRIS data for prediction of future hazard (Crowley and Zimbelman, 1997), Mars Observer Camera (MOC) image analysis for debris avalanches on Mars (Baratoux et al., 2002; Skilling et al., 2002), and observation by new satellite Daichi for debris avalanche at Leyte, Philippine (Koarai et al., 2008) are reported. Making comprehensive debris avalanche data catalogue and future collapse prediction using remote sensing technology are important for further debris avalanche studies.

Researches on submarine debris avalanches are developed rapidly these days. For example, Hawaii islands (Garcia, 1996; McMurtry et al., 1999; Moore and Clague, 2002), Canary islands (Masson, 1996; Cantarel et al., 1999; Krastel et al., 2001), Lesser Antilles islands (Fraiant et al., 2002; Deplus et al., 2001), Vesuvius (Milia et al., 2003), Etna (Rasa et al., 1996), and Oshima-Oshima (Satake and Kato, 2001) are studied recently. Large-scale Tsunami may be caused by volcanic submarine debris avalanche (Waythomas, 2000). Therefore, further studies on more complete distribution, occurrence frequency, and collapse prediction of submarine debris avalanches are getting important.

Some hot debris avalanches are reported recently. Growing hot lava dome was collapsed including its basement caused hot debris avalanche at Soufriere Hills, Montserrat on Dec. 1997 (Voight et al., 1998). A hot debris avalanche is found at Colima volcano using TRM measurement (Clement et al., 1993). A debris avalanche with hot ignimbrite blocks, which formed during caldera formation, is described (Fackler-Adams and Busby, 1998).

Collapse mechanism of debris avalanche is getting revealed. Such as, lateral movement due to intrusion of plutonic complex (Rust and Neri, 1996), lateral sliding due to large-scale decollement plane (Rasa et al., 1996), gravitational thrusting and sliding due to basement uplift (McGuire, 1996), and reactivation of basement faults beneath volcano (Vidal and Merle, 2000) are proposed. Destabilization and decompression of magma reservoir system due to sector collapse is also proposed (Schminke, 2004). Relation between evolution of a volcano and occurrence of debris avalanche is interesting further studies.

Transport mechanism of debris avalanche such as deformation processes based on internal features (Mehl and Schminke, 1999), fracturing mechanism due to conjugate faulting (Reubi and Hernandez, 2000), emplacement processes based on AMS measurements (Schneider and Fisher, 1998), emplacement mechanism based on internal deformation and SEM particle images (Shea et al., 2008), and computer simulations (Sousa and Voight, 1995; Denlinger and Iverson, 2001; Evans et al., 2001) are proposed recently. Further discussions based on internal features and simulations are still needed to reveal transport mechanism of debris avalanches.