V-079

Understanding the Variations of Internal Sedimentary Structures and Material Characteristics at Unzen using Ground Penetrating Radar

神戸大学大学院海事科学研究科　○Gomez Christopher
東京大学農学部　堀田　紀文
宮崎大学農学部　篠原　慶規
東京大学大学院農学部農学生命科学研究科　酒井　佑一
森林総合研究所　経隆　悠
九州大学大学院生物資源環境科学府　矢野　敦久
筑波大学生命環境科学研究科　北本　楽
神戸大学大学院海事科学研究科　坂本　実紀

1. Research Background and Objectives

Lahars contribute to the dismantlement of volcanic structures long after eruptions stop. And although the triggering may occur in relatively homogeneous material at first, as time passes the frequency of lahars decreases, leaving space for other erosive processes to occur in between while at the same time, older or remobilized material serves as the source of lahars, significantly modifying their triggering conditions.

The complexity of lahar deposit structures from Ground Penetrating (GPR) surveys have been evidenced at Semeru and Merapi Volcano 1), 2), 3) but along the talweg, research has only concerned valleys with regular and high volume lahars 4).

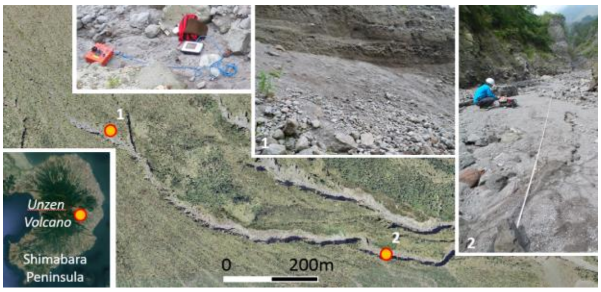

Fig. 1 Field in the Gokurakudani, at Unzen Volcano (Shimabara Peninsula).

The present research aims to image the subsurface of lahar valleys at Unzen Volcano, a complex chain of sediment transport and deposition processes.

2. Research location

The research location is in Nagasaki Prefecture (Japan), on the peninsula of Shimabara occupied by Unzen Volcano at its centre (1359 m a.sl.). The research has been concentrated on the Eastern Flank of the volcano (Fig. 1) where most of the 1991-1995 eruption modified the landscape through dome-collapsed pyroclastic flows 5) and lahars 6).

3. Method

3.1 Field acquisition

The GPR survey has been performed with a GSSI SIR-3000 mounted with a 400 MhZ antenna. The topography was recorded using a handheld GNSS (horizontal precision 5 m) and the UAV-based structure-from-motion data.

3.2 Data processing

The GPR radargram were with the Reflex platform, using the 2D processing module. First, a static time filter was applied to remove the time travelled through the air and the plastic of the antenna before reaching the soil. Then the signal was enhanced to increase the refraction patterns using the AGC gain, with a factor of 1.44. An energy loss compensation with a 1.2 factors at 80 ns was applied. Then the horizontal surface echo was minimized with a moving average window subtraction with a window opening of 100 traces. After signal improvement, the velocity data were transformed into depth using the refraction hyperbolae created by the single blocks in the substratum. The measured velocities are between 0.04 $m.ns^{-1}$ and 0.06 $m.ns^{-1}$.

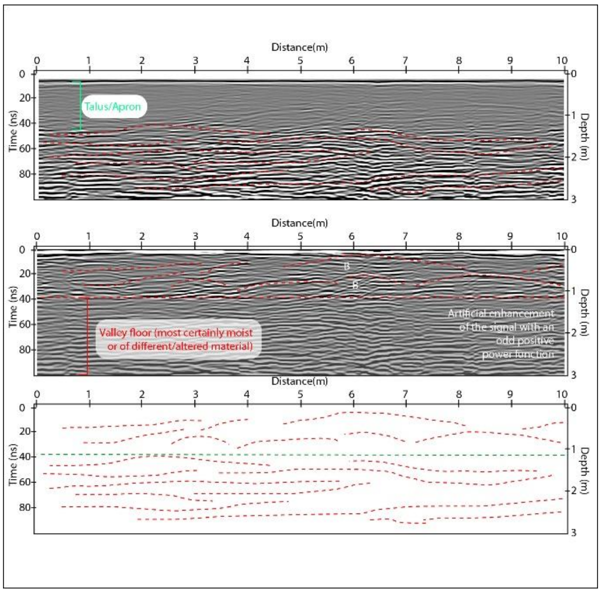

Fig. 2 Radargram at location 1 (fig. 1)

4. Results and Discussion

Starting upstream, the radargram at location 1 (Fig. 1) recorded over the apron shows two horizontal series with a clear delineation between a 1.5 to 1.8. The upper part of the structure characterizes the apron and the subhorizontal layers below are the deposits from the talweg. Those units however are different from typical lahar valley talwegs, and may be interpreted cautiously as potential remobilization of the previously present apron. Downstream, the radargram shows a series of downstream prograding layers, typical of the pattern identified at other volcanoes for valley talwegs. However, intercalated in this structure and in the upper 1 m of the structure, there is an accumulation of clasts between 20 m and 30 m, with layers displaying a multi-lenses structure (Fig. 2).

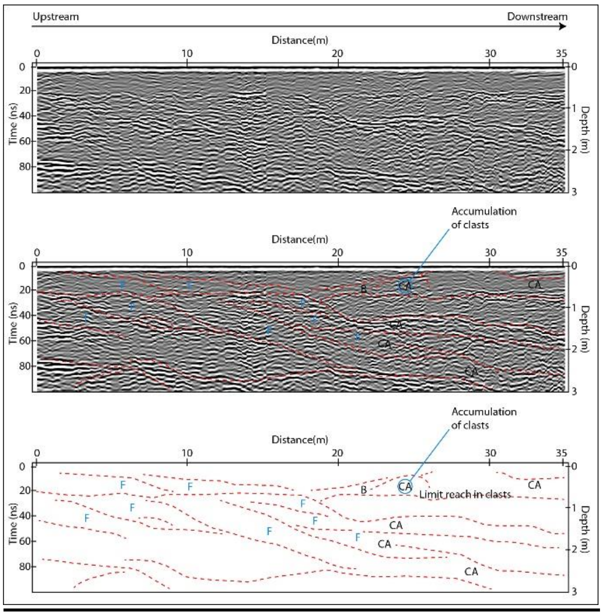

Fig. 3 Radargram for location 2 (cf. Fig. 1)

5. References

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