Grain Size Distribution of the 1926 Volcanic Mudflow at Mt. Tokachi, Japan

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INTRODUCTION

In May 1926, a volcanic mudflow triggered by the eruption of Mt. Tokachi, named "1926 mudflow", ran through the Furano and Biei Rivers in Hokkaido Japan, and killed 144 residents along the course (**Fig. 1**). According to Nanri et al. (2016), the fluid dynamic force reached more than 10^2 KN/m even on the mudflow deposition area of the Furano River and completely destroyed 30-40% of houses there. This paper analyzed the grain size distribution along the river to suggest the reason why the mudflow could maintain such large force even on the gentle plain, the slope of which was only 1/100.

METHOD

The 1926 mudflow deposits were sampled at 8 sections; 2 sections (**Fig. 1**: U1, U2) in the Source and Scoring zone, 2 sections (Same: U3, U4) in the Transport zone, 3 sections (Same: D1-D3) in the Deposition zone, and 1 section in the downstream of the Deposition zone. The samples were

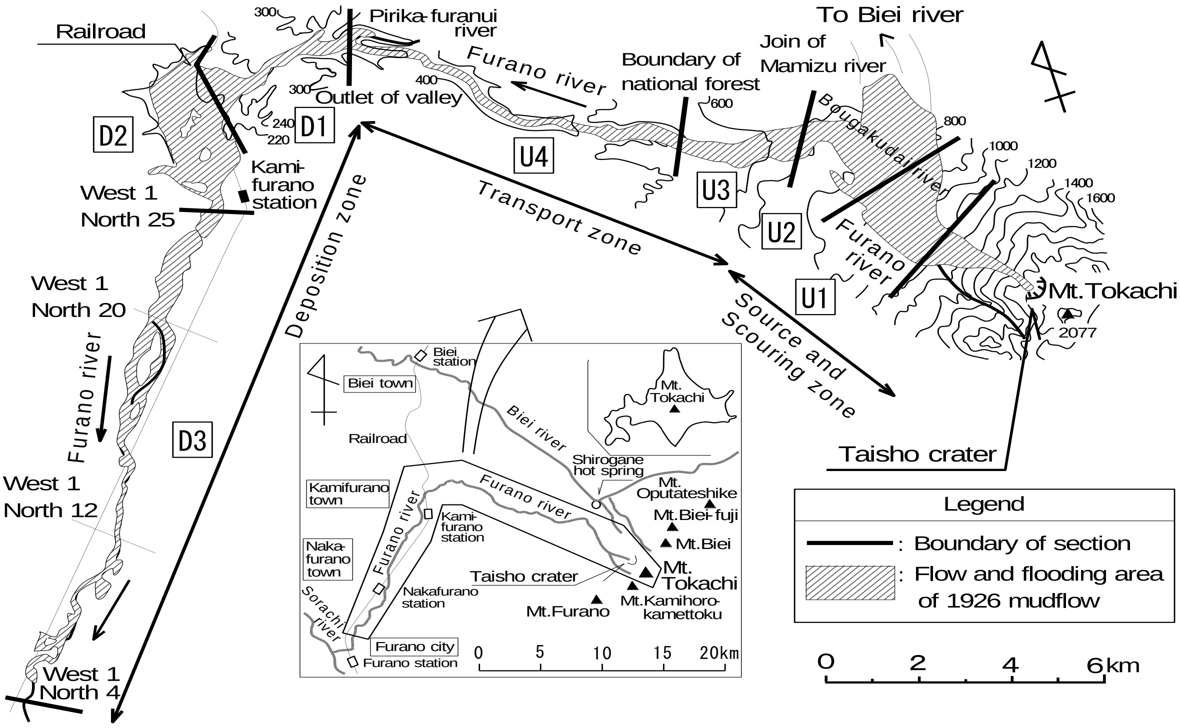

Fig. 1 Location of analysis unit areas and 1926 mudflow flowing area

then analyzed and categorized into three groups, Very fine (< 0.1 mm in diameter), Fine (0.1-2 mm in diameter), and Coarse (≧2 mm in diameter). At each section, the proportion of each group occupying the sample were multiplied by the net volume of the mudflow deposition provided by Nanri et al. (2009), to estimate the volume of each grain group contributed to (**Fig. 4**).

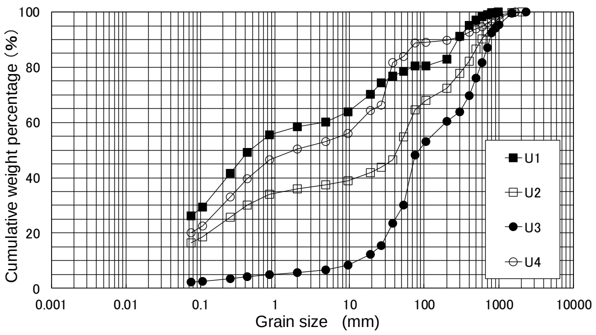

Fig. 2 Grain size distribution of mudflow deposit in Source and Scouring zone and Transport zone

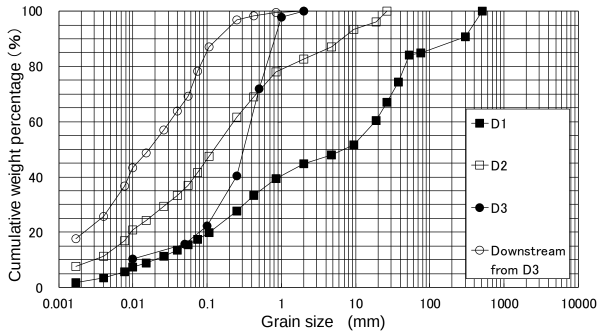

Fig. 3 Grain size distribution of mudflow deposit in Deposition zone

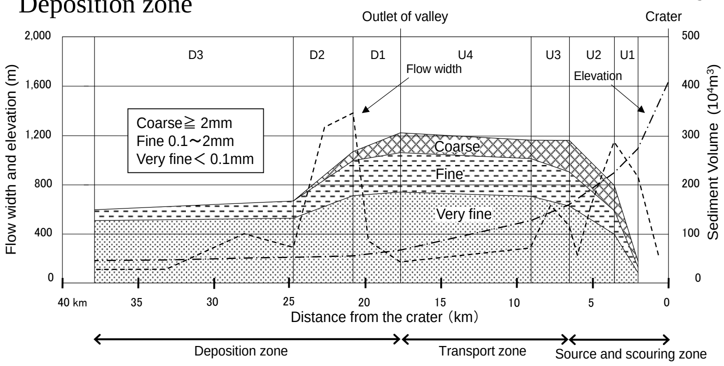

Fig. 4 Longitudinal changes in grain size distribution of 1926 volcanic mudflow

RESULTS

In the upstream U1-U4 sections, U3 was the most coarse-grain section: less than 2 mm of sediment occupied 5% (**Fig. 2**). In the downstream D1-D3 sections, D1 was the most coarse-grain section. D2 and D3 sections were similar in the 60% grain diameter (**Fig. 3**). At the downstream end of the Source and Scouring zone, "Very fine" materials occupied about a half of the net deposition volume (**Fig. 4**). It increased to 60 % at the end of the Transport zone, or the outlet of the valley, and then reached to 85 % at the downstream end of the Deposition zone.

Nanri et al. (2016) demonstrated that the roughness coefficient of the mudflow was 0.03 in average through the Furano River, and the flow density was 1.6-1.7× 10^3 kg/m^3 , unlike either debris flow or flood flow. Their results agreed with the outcome of this study, that is, the 1926 mudflow contained an enormous proportion of "Very fine" materials along the downstream reaches to maintain large fluid dynamic force.

CONCLUSIONS

This study presented that the 1926 mudflow contained rich of fine materials less than 0.1 mm in diameter even through the gentle plain resulting in large fluid dynamic force, leading to huge damage to houses more than 20 km far from the site that mudflow initiated.

REFERENCES

Nanri. T., Fukuma. H., Harada. N., Ando. H., Ito. H., Hashinoki. T., and Yamada. T. (2009): Flow and sedimentation process of 1926 volcanic mudflow based on the field investigation data analysis, at Mt. Tokachi, J. Jpn. Soc. Erosion Control Eng., Vol. 61, No. 5, p. 21-30 (in Japanese with English abstract)

Nanri. T., Yamada. T., Kasai. M., and Marutani T. (2016): Disaster map of the Taisho volcanic mudflow informing the arrival time and the level of damage after the eruption of Mt. Tokachi in 1926, J. Jpn. Soc. Erosion Control Eng., Vol. 69, No. 1, p. 12-19 (in Japanese with English abstract)

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