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# Debris formation in Southeast Tibet from weathering, avalanching, rock falling and mass movement

Yanjun Shang<sup>a</sup>, Hyeong-Dong Park<sup>b,\*</sup>, Zhifa Yang<sup>a</sup>, Luqing Zhang<sup>a</sup>

<sup>a</sup>*Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing 100029, China*

<sup>b</sup>*School of Civil, Urban and Geosystem Engineering, College of Engineering, Seoul National University, Seoul, South Korea*

## Abstract

Weathering, avalanching and mass movement breakage are three active and significant ways contributing via gradual or sudden procedures to the formation of loose materials at the ground surface in Southeast Tibet. Weathering is intensive on the slope surfaces. For example, one granodiorite block exposed on a gentle slope surface over a 1-year interval (February 2001–February 2002), had a weathering rate of about 41.2–52.7%/year (Fig. 1a).

The occurrence of rock mass avalanches and rock falls with a high velocity arising from a fractured rock mass is seldom observed in steep slopes. However, one occurring in granodiorite, from a slope with a height of about 400 m and an angle of about 70° in the upper part and 40° in the lower part, was fortunately recorded on February 2002 (Fig. 1b). The 10–50 m<sup>3</sup> of rocks broke out and fell downward within 3 min. Moving through the slope, about 10 rocks fell onto the highway.

With a 100-year recurrence interval and a volume of  $3 \times 10^8$  m<sup>3</sup>, the Yigong Landslide occurred on 9 April 2000 with debris formation, some from landslides, some from the mass movement breakage, in Zhamu Creek with an area of 20.2 km<sup>2</sup> (Fig. 1c) and a rate of debris formation roughly 0.149 m/year.

Observations and records like these three examples provide significant results for understanding that there are many different kinds and sizes of fragments and grains at the slope toe or in the valley floors as loose materials, which were mostly bound up in the debris flow and landslides in this area. The rate value is useful, not only because it reflects the loose material formation naturally, but also plays a role as basic data for geo-engineering design and measurement for the prevention of geological hazards.

*Keywords:* Rock mass; Weathering; Avalanche; Landslide; Tibet

\*Corresponding author. Tel.: +86-10-62007318; fax: +86-10-62040574.

E-mail address: [giscity@hanmail.net](mailto:giscity@hanmail.net) (H.-D. Park).

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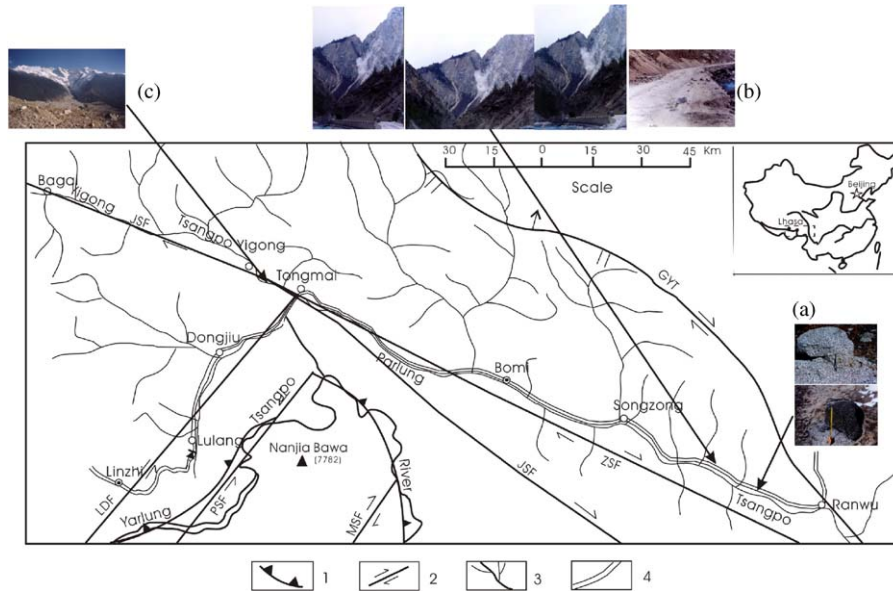


Fig. 1. Three main ways contributing to loose material formation in Southeast Tibet: (a) Comparison of physical weathering of granodiorite as decreasing in size during 1 year from February 2001 to February 2002; (b) from beginning to end of a rock avalanche in about 3 min and fallen rocks in the highway surface from the rock avalanche in the hill peak; (c) an overview of the Zhamu Creek from its mouth to the source area (peak) 1—suture; 2—strike-slip fault: GYT=Guyu strike-slip and thrust fault; JSF=Jiali strike-slip fault; LDF=Linzhi-Dongjiu strike-slip fault; MSF= Motuo strike-slip fault; PSF= Paiqu strike-slip fault; ZSF= Zayu strike-slip fault; 3—streams; 4-highway.