# Characteristics and Formation Mechanism of the Liquefaction-Induced Landslide-Debris Flow in Zhongchuan Township, Qinghai, Triggered by the Jishishan Ms6.2 Earthquake: A Postprint

**Authors:** Xu Qiang, Peng Dalei, Fan Xuanmei, Dong Xiujun, Zhang Xiaochao, Wang Xin

**Date:** 2025-08-20T00:00:00+00:00

## Abstract

The Ms 6.2 Jishishan, Gansu earthquake on December 18, 2023 triggered a typical earthquake-induced liquefaction landslide-mudflow in Jintian Village and Caotan Village, Zhongchuan Township, Minhe County, Haidong City, Qinghai Province, burying numerous houses under mud several meters thick. Due to its remarkable suddenness and exceptional mobility, it was initially misidentified as "sand boil." Through field investigation and remote sensing interpretation analysis, this geological hazard was confirmed as an earthquake-triggered liquefaction landslide-mudflow, and its formation mechanism was investigated. The results indicate that: (1) This geological disaster resulted from vibration loading during the earthquake causing liquefaction of a saturated silt layer (loessified) at the plateau base, forming a landslide that transformed into a mudflow; the mudflow traveled along gullies and spread upon reaching the villages, rather than being a traditional in-situ "sand boil"; (2) The source sliding area exhibited two failure modes during liquefaction: dispersive failure and lateral spreading; (3) Earthquake-induced soil liquefaction predominantly occurs in saturated granular materials (silty loess, fine sand, etc.) with pronounced strain-softening characteristics. Such geological hazards are characterized by sudden occurrence and often exhibit fluid-like, long-runout movement after instability, easily leading to catastrophic consequences that warrant serious attention.

## Full Text

## Preamble

**Preliminary Study on the Characteristics and Initiation Mechanism of Zhongchuan Flowslide Due to Liquefaction Triggered by the Ms**

### 6.2 Jishishan Earthquake in Gansu Province

XU Qiang[1], PENG Dalei[1], FAN Xuanmei[1], DONG Xiujun[1], ZHANG Xiaochao[1], WANG Xin[1]

[1] State Key Laboratory of Geohazard Prevention and Geoenvironment Protection, Chengdu University of Technology, Chengdu 610059, China

## Abstract

The Ms 6.2 Jishishan earthquake that struck Gansu Province on December 18, 2023, triggered a typical liquefaction-induced landslide-mudflow in Jintian and Caotan villages of Zhongchuan Township, Minhe County, Haidong City, Qinghai Province. The disaster buried numerous houses under mud several meters thick. Due to its sudden onset and exceptional mobility, the event was initially misidentified as "sand boils." Through field investigation and remote sensing interpretation, this study confirms that the geological disaster was a liquefaction-type landslide-mudflow triggered by the earthquake and explores its initiation mechanism.

The results indicate three key findings: (1) The disaster was not a traditional in-situ "sand boil" phenomenon. Instead, seismic vibrations during the earthquake liquefied a saturated silt layer (loess-derived) at the base of the plateau, initiating a landslide that transformed into a mudflow. This flow traveled along a gully to reach the villages, where it spread out and caused the observed devastation. (2) The source area exhibited two distinct failure modes during liquefaction: dispersive failure and lateral spreading. (3) Earthquake-triggered soil liquefaction predominantly occurs in saturated granular materials—such as silty loess and fine sand—that exhibit pronounced strain-softening characteristics.

Such geological hazards are characterized by their sudden occurrence and typically exhibit fluid-like, long-runout behavior after failure, often leading to catastrophic consequences that warrant significant attention.

**Keywords:** Earthquake landslide-mudflow; Dispersive landslide; Lateral spreading; Seismic liquefaction; Jishishan earthquake

*Note: Figure translations are in progress. See original paper for figures.*