工程地质学报
JOURNAL OF ENGINEERING GEOLOGY

工程地质学报 » 2012, Vol. 20 » Issue (3): 340-349 DOI:

汶川县渔子溪地震地质灾害特征及灾害链成生分析

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FEATURES AND CHAINS GENESIS ANALYSIS OF EARTHQUAKE GEO-HAZARDS IN YUZI STREAM OF WENCHAN COUNTY

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摘要 渔子溪下游耿达乡-映秀镇河段是汶川地震触发震害最为严重、灾害链效应最为显著的河段之一。本文通过详细的实地调查和遥感影像分析,力求揭示该河段地质灾害的特征及灾害链的成生过程、成生条件。依据震害特征,将地质灾害划分为斜坡中上部强风化岩土体失稳坠落、块状岩质边坡滑移式垮塌及局地暴雨启动型泥石流3类,并分析震害发育规律。调查表明,灾害点的空间展布受控于发震断裂,且北岸发育密度更大,茂汶断裂两侧差异显著。对51个崩塌点及17条泥石流研究发现,地震崩塌灾害主要发生在40° 以上斜坡,主要分布在斜坡中上部(0.4倍坡高以上)及地貌突出部位,且大纵比降的壮年期沟谷易发泥石流。同时,诱发因素的转变致使地质灾害向降雨主导的小规模单体崩塌、泥石流方向发展。区内主要存在2种地质灾害链:(1)内动力地质灾害链"地震→崩塌→压迫河道、毁路或形成堰塞湖",其成生过程经历高速启动、滑移运动、堵河3个阶段; (2)内外动力耦合作用地质灾害链"地震→崩塌、震裂山体→暴雨→泥石流→压迫河道、毁路或形成堰塞湖",成生过程可划分为启动、堵塞(沟谷后)溃决、铺床、堵河4个阶段。灾害链的成生条件概括为:脆弱的地质环境; 强烈地震动震垮、震裂高陡斜坡(>50m,>40°); 强降雨及适宜的堵河条件。

关键词: 5·12汶川地震 8·13强降雨 地震地质灾害 成生过程 成生条件

Abstract: Under the influence of 5.12 earthquake, the geo-hazards are extreme serious in the reach of the Yuzi Stream form Gengda to Yingxiu. The geo-hazard chains are also very prominent. Through field investigation and remote sensing interpretation, this paper tries to reveal the characteristics and genetic process and conditions of geologic hazards in the stream. Based on their characteristics, the geo-hazards are divided into three types. They are (1) instability and crash of the highly weathered rock-mass and soil on the upper slopes, (2) collapse of massive rock-mass slope, and (3) local downpour types of debris flows. The geo-hazards are controlled by seismic fault and the density is higher on the north shore. They show significant deviations between the two sides of Maowen fault zone. 51 collapses and 17 debris flows are analyzed. The geo-hazards mainly took place on the slopes steeper than 40° . The instability positions are mainly upon the parts with slope gradients more than 0.4 and failure zones distribute on the upside of the slopes. Debris flows mainly occur in the valley of the large slope and manhood. The geo-hazards can be transformed into small-scale single collapses and debris flows induced by rainfall. There are mainly two types of geo-hazard chains: (1) geo-hazard chains due to inner dynamic-"earthquake → collapses → stream squeezed, road destroyed and the barrier lakes". The genetic process includes three stages: high-speed start, glide motion, stoppage; (2) geo-hazards chains due to the inner and outer dynamic coupling effect-"earthquake → collapses and shattered mountains → rainstorm →debris flows → stream squeezed, road destroyed and the barrier lakes". The genetic process can be divided into four parts: preparation, dam-breaking after the valley blocked, bed-making and stoppage. The genetic conditions of geo-hazard chains can be concluded as follows: vulnerable geology environment, high steep slope (>50m, >40°) collapsed and shattered by the strong ground motion, the heavy rainfall and suitable conditions for blocking the river.

Key words: 5?2 Wenchuan earthquake 8?3 heavy rainfall Earthquake geo-hazards Genetic process Genetic conditions

收稿日期: 2012-01-20;

基金资助:中国地质调查局项目(1212010914010), 国家重点基础研究发展计划(973)项目(2008CB425801)资助

陈宁,王运生,蒋发森等. 汶川县渔子溪地震地质灾害特征及灾害链成生分析[J]. 工程地质学报, 2012, 20(3): 340-349.

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