

Changbaishan seismic monitoring network and recent unrest of the volcano

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Changbaishan volcano is the largest potential eruptive volcano in China. Over 12 years of continuous monitoring of Changbaishan volcano by means of volcanic seismicity, ground deformation, and volcanic gas geochemistry, new evidence for magmatic unrest of the volcano was found during 2002-2005. In this so-called "active period" the frequency of volcanic earthquakes increased sharply accompanied by earthquake swarms. Active period was also accompanied by ground inflation, high values of CO₂, He, H₂, and high ratios of ³He/⁴He in volcanic gases released from three hot springs near the caldera rim. The monitoring evidence implies pressurization of the magma chamber, possibly caused by incremental magma recharge. The ground deformation data from both GPS and precise leveling are modeled to suggest the corresponding deformation source at 2-6 km beneath the volcano's summit, where earthquake swarms were detected in 2002 and 2003. Our findings suggest that the magma chamber beneath Changbaishan volcano has waked up and resumed its activity after it has remained dormant since AD 1903.

Changbaishan volcano has remained inactive since 2006, however several abnormal signals have been observed in recent years that need special attention. In 2009, precise leveling measurement both in the north and west slope of this volcano show a change of ground deformation mode from inflation to deflation. The water temperature of Julong hot spring suddenly rose to 77.7°C, about 3°C higher than in 2010, and this abnormal signal persists to the present. Taken together, all these new phenomena might indicate the beginning of a new "active period". The episodic unrests probably caused by pulse of mantle magma intruding into the upper crust.

The magma unrest process in Changbaishan volcano from 2002 to 2005 might be considered as a long term precursor of the potential eruptive activity. However, earthquake swarms and volcanic tremors have not been observed since 2006, volcanic gas geochemistry also has no obvious abnormal indication, the volcano is still in its inactive period now.

Key words: volcano; volcanic event; earthquake; precursor