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# Seismicity characteristics of a potentially active Quaternary volcano: The Tatun Volcano Group, northern Taiwan

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## Abstract

The Tatun Volcano Group (TVG) is located at the northern tip of Taiwan, near the capital Taipei and close to two nuclear power plants. Because of lack of any activity in historical times it has been classified as an extinct volcano, even though more recent studies suggest that TVG might have been active during the last 20 ka. In May 2003 a seismic monitoring project at the TVG area was initiated by deploying eight three-component seismic stations some of them equipped with both short-period and broadband sensors. During the 18 months observation period local seismicity mainly consisted of high frequency earthquakes either occurring as isolated events, or as a continuous sequence in the form of spasmodic bursts. Mixed and low frequency events were also present during the same period, even though they occurred only rarely. Arrival times from events with clear P-/S-wave phases were inverted in order to obtain a minimum 1D velocity model with station corrections. Probabilistic nonlinear earthquake locations were calculated for all these events using the newly derived velocity model. Most high frequency seismicity appeared to be concentrated near the areas of hydrothermal activity, forming tight clusters at depths shallower than 4 km. Relative locations, calculated using the double-difference method and utilising catalogue and cross-correlation differential traveltimes, showed insignificant differences when compared to the nonlinear probabilistic locations. In general, seismicity in the TVG area seems to be primarily driven by circulation of hydrothermal fluids as indicated by the occurrence of spasmodic bursts, mixed/low frequency events and a *b*-value ( $1.17 \pm 0.1$ ) higher than in any other part of Taiwan. These observations, that are similar to those reported in other dormant Quaternary volcanoes, indicate that a magma chamber may still exist beneath TVG and that a future eruption or period of unrest should not be considered unlikely.

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## 1. Introduction

Volcanic activity can pose a severe threat to nearby densely populated areas and to sensitive facilities such as nuclear power plants (Tilling, 1989; McBirney and Godoy, 2003). Mitigation of volcanic hazards can usually be achieved by a coordinated volcano monitor-

ing program that encompasses a number of multidisciplinary (geophysical, geodetic, geochemical) techniques in order to detect any early signs of unrest. Many such programs have been already implemented in developed countries like Japan or the United States but most of them are restricted to volcanoes that have erupted in historical times. However, one major problem in volcanological research is the distinction between a volcano that is capable of erupting after a long repose time and one that is not. This problem, beyond its

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