

## Caldera unrest at Taupo Volcano, New Zealand: intensity, impacts and mitigation

Sally H Potter<sup>1</sup>, Gill E Jolly<sup>1</sup>, Vince E Neall<sup>2</sup>, David M Johnston<sup>3</sup>

<sup>1</sup>GNS Science, 114 Karetoto Road, Wairakei, New Zealand, <sup>2</sup>Massey University, Private Bag 11 222, Palmerston North, New Zealand, <sup>3</sup>Joint Centre for Disaster Research, Massey University, P.O. Box 756, Wellington, New Zealand

E-mail: s.potter@gns.cri.nz

Taupo Volcano is considered one of the most active caldera centres in the world. Its last eruption occurred in 232 AD, in a 35 km<sup>3</sup> volume (DRE), rhyolitic, caldera-forming eruption which devastated a large portion of the Central North Island of New Zealand. Prior to eruptions volcanoes exhibit signs of unrest commonly in the form of seismicity, ground deformation or hydrothermal or geochemical changes. The integration and interpretation of these phenomena is considered key to eruption forecasting. The majority of unrest episodes at calderas do not result in eruptions leading to potential "false alarms". Identifying the range of possible future multi-parameter unrest activity based on previous events at the volcano contributes to eruption forecasting.

This research involves a historical chronology of all volcanic activity observed at Taupo Caldera since written records began in the 1850s. Document analysis of newspaper articles, local and scientific literature, correspondence and analysis of monitoring data contributed to the dataset. From this, a catalogue was created summarising 91 episodes of heightened activity.

The wide range of intensity of episodes found in this research questions the definitions of the terms "background" and "unrest" commonly used in the literature. The complete range of activity at any type of volcano seen during periods of quiescence (including caldera unrest) is described here as Non-Eruptive Volcanic Activity (NEVA).

The physical impacts of NEVA at Taupo Caldera include subsidence of 3.7 m over a period of months, seiches in the lake which fills the caldera and episodes with an average of 100 earthquakes felt per day. Societal impacts reported include anxiety, self-evacuations, damage to infrastructure and a perceived impact on the local and regional economies.

In order to help mitigate the impacts of future caldera unrest in New Zealand, a Caldera Advisory Group has been formed. This is a multi-agency strategic planning group organised by regional councils. Other members include the Ministry of Civil Defence and Emergency Management, local councils and GNS Science. Outputs of this Group include a caldera unrest information sourcebook for non-scientists, and a scenario for planning purposes based on the past NEVA at Taupo Caldera.