

## Towards an understanding of long-term change of the long-period tremor source at Aso volcano - Analyses of seismograms in 1930s -

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Volcanic tremors are considered to be generated by the motion of volcanic beneath active volcanoes, and the elucidation of these signals is one of the critical keys to understand the dynamics of the volcanic system. Recent studies suggest the possibilities to infer the temporal change of physical properties of such volcanic fluid from the change in the oscillatory characteristics of the observed signals. However, on the other hand, the conventional seismological studies mainly concentrate on the analyses of seismic signals observed during active period of volcanoes, and not so much attention have been paid to the long-term change of properties of the volcanic tremors.

In this study, to investigate the change in the state of the volcanic fluid system beneath volcanoes, as an example, we aim to gain a quantitative understanding of the long-term change in tremor properties observed Aso volcano by analyzing old seismograms. In the presentation, I present the methodology to extract tremors signals from the old paper-based seismic records, and explain the characteristics of the tremor signals retrieved from smoked papers recorded in 1930s.

At Aso volcano, continuous seismic observation using Wiechert seismometers has been conducted by Kyoto University since 1929, and tremor signals have been recorded on smoked papers. To retrieve seismic signals from the paper-based records efficiently, we scan the original smoked papers using a flat bed scanner with a resolution of 600 dpi, and process the scanned images using newly developed software. We use the Thinning Algorithm proposed by Govindan et al. (1987) and the Kalman filter to automatically trace the seismic records.

From the digitized seismograms, it is revealed that the second-kind volcanic tremor detected by Sassa (1935, 1936) also has a series of overtones just like the long-period tremors observed over the last decade using the modern broadband seismometers, and the periods of the tremors gradually varies in accordance with the change of the surface volcanic activities. These results suggest that just beneath the active craters there exists a volcanic conduit system similar to the present one even in 70 years ago, and the interaction between the volcanic edifice and the volcanic fluid inside the conduit generates long-period volcanic tremors.