The bubble buku-buku phenomenon and its controlling mechanism

Mie Ichihara[1]; Valerie Vidal[2]

[1] ERI,Univ. of Tokyo; [2] CNRS, ENS de Lyon

By supplying a constant air flux from the bottom of a non-newtonian fluid, we observed quasi-periodic bubble bursting at the surface and a systematic modulation in the acoustic waveforms. Vidal et al. (JPGU2008) presented a mysterious correlation between this modulation in the bursting sound and a small precursory acoustic signal observed just before bursting. We named this phenomenon as a bubble buku-buku process. Ichihara et al. (JVC2008) further presented background bubbles in the fluid play an essential role in generating this phenomenon. However, its mechanism has not been unraveled.

In this study, we performed detailed observation of the processes generating the precursor signal and bursting sounds and propose a model explaining their correlation and the origin of the modulation.

The precursor signal is generated by the coalescence of a rising bubble and a small bubble trapped just beneath the surface, which is the remnant of the previous bursting bubble. The waveform of the bursting sound is generally determined by the resonant frequencies of the bubble at bursting and the excitation. The analyses of its spectral features indicate the major change in its modulation is caused by the excitation. Further investigation of the complex rheological properties of the fluid point out that both the condition of the trapped bubble and the way of bursting are affected by the existence of the yield stress and memory effect of the fluid.

These experimental results provide insights into various repetitive and quasi-periodic phenomena observed in volcanic processes.