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Sedimentation influx and volcanic interactions in the Fuji Five Lakes: implications for paleoseismological records

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The Fuji Fives Lakes are located at the foot of Mount Fuji volcano close to the triple junction, where the North American Plate, the Eurasian plate and the Philippine Sea Plate meet. These lakes are ideally situated to study Mount Fuji volcanism and the interaction between volcanism, changes in lake sedimentation rates and the ability of lakes to record paleoearthquakes. Here, we present newly acquired geological data of Lake Yamanaka and Lake Motosu, including seismic reflection profiles, gravity and piston cores.

These two lakes and their respective watersheds were affected by several eruptions of Mount Fuji. Lake Yamanaka, a very shallow lake (max. depth 14 m), was heavily impacted by the scoria fall-out of the A.D. 1707 Hoei eruption of Mount Fuji. A detailed investigation of the effect of the Hoei eruption was conducted on short gravity cores, using high resolution XRD, C/N and 210Pb/137Cs analyses. The preliminary results suggest that the sedimentation rate of Lake Yamanaka drastically reduced after the Hoei eruption, followed by an increase until the present day.

Similarly, lacustrine sedimentation in Lake Motosu (max. depth 122 m) was disturbed by Mount Fuji volcanism at a larger scale. The watershed of Lake Motosu was impacted by several lava flows and scoria cones. For example, the Omuro scoria cone reduced the catchment size of Lake Motosu and modified its physiography. The related scoria fall out covered an extensive part of the lake catchment and reduced terrigenous sedimentary influx to Lake Motosu. Within the deep basin of Lake Motosu, seismic reflection data shows two different periods that are distinguished by a major change in the dominant sedimentary processes. During the first period, sublacustrine landslides and turbidity currents were the dominant sedimentation processes. During the second one, the seismic stratigraphy evidences only deposition of numerous turbidites interrupting the hemipelagic sedimentation. Changes in sedimentary processes can be linked to the modification of the lake watershed by Mount Fuji volcanism, leading to a decrease in the sediment volume that can be remobilized, and therefore disappearance of large sublacustrine landslides. Turbidites are deposited due to surficial remobilization of lake slope sediments most probably as a result of earthquake shaking.

When studying sedimentological records of lakes to define the paleoearthquake record, eruptions of nearby volcanoes should be taken into account. This study suggests that a large magnitude earthquake occurring few decades after a volcanic eruption (with large scale scoria fall-out), might not be recorded in a lake, or would only be fingerprinted in the sedimentary record by small turbiditic flows.