

Trench excavation in the lacustrine sediments in a dammed lake formed by the Dondokosawa rock avalanche and high-resolution landslide chronology using oxygen isotopic dendrochronology

*Ryuji Yamada¹, Yoshihiko Kariya², Kimio Inoue³, Takashi Kimura¹, Masaki Sano⁴, Zhen Li⁵, Akane Tsushima⁵, Takeshi Nakatsuka⁵

1. National Research Institute for Earth Science and Disaster Resilience, 2. Senshu University, 3. Sabo Frontier Foundation, 4. Waseda University, 5. Research Institute for Humanity and Nature

Dendrochronology, which has been mainly used in archaeology, is the science or technique of dating events, environmental changes in the past by using the characteristic patterns of annual growth rings in trees based on the fact that features of tree-rings are individually synchronized reflecting the annual changes in climatic factors such as temperature and precipitation. In recent years, applicable areas of dendrochronology have extensively been expanded by measuring instrumentally the oxygen isotopes of cellulose extraction instead of the widths as an index of changes. It is necessary to establish regional standard chronology (master chronology) as long as possible for dating of woods from various periods for both of widths and isotopes, and therefore the dendrochronological analysis can be performed in the latest ca. 3000 years under the status quo in Japan. Because climate sensitivity of tree-ring width depends on tree species, it is difficult to apply the master chronology made for a specific species to analysis for another species. On the other hand, tree-ring cellulose oxygen isotopic ratio reflects only two meteorological parameters (precipitation isotope ratios and relative humidity during growing season), and its variation shows high coincidence among different species. Oxygen isotopic dendrochronology consequently enables us to reconstruct palaeo climate annually (or seasonally if tree-rings sliced).

The Dondokosawa rock avalanche (DRA) blocked the main stream of the Dondokosawa River and formed dammed lakes besides the debris (Kariya, 2012). Many woody plant fossils were observed there. Yamada et al. (2018) applied the dendrochronological analysis using tree-ring oxygen isotope ratios to two tree trunks preserved in fairly good condition in the lacustrine sediments, and obtained their death years of around AD885 and AD888. Compared with historical records of large earthquakes in old documents such as *Shoku Nihongi* (a chronicle of Japan edited in AD 797), these ages implied that DRA occurred at the year of AD887 Ninna (Goki-Shichido) earthquake, which was one of the gigantic ocean-trench earthquakes along the Suruga and Nankai Troughs off central Japan, or at a couple of years later than this earthquake. Because several active faults in the southern segments of Itoigawa-Shizuoka Tectonic Line (ISTL) active fault zone run through in this area, one of these fault could remotely be triggered by the Ninna great interplate earthquake, like the case of the northern Nagano Prefecture earthquake (on March 12, 2011; M = 6.7) after the 2011 Tohoku earthquake (on March 11, 2011; M = 9.0).

We conducted an additional trench excavation in the lacustrine sediments in one of dammed lakes along the Dondokosawa River, and some buried tree trunk samples could be taken there in August 2016. Their conditions were not good because tree barks are detached while sampling. Dendrochronological dating yielded estimated years of AD830-880 for the outer most tree-rings remained (death years should exceed them) of the most of trunk samples, which were consistent with previous estimates. Outlines of the trench excavation and details of dendrochronological analysis are to be reported.

References: Kariya (2012) Trans. Jpn. Geomorphol. Union 33, 297-313.; Yamada et al. (2018) Quat. Geochr. 44, 47-54.

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