

A novel laser-melting ice-core sampler with high depth resolution and high throughput for discrete ice core analyses

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Ice cores preserve past terrestrial phenomena, e.g., climate changes and volcanic eruptions. Moreover, if the ice cores contain the components from the stratosphere that were affected by cosmic rays, the footprints of extraterrestrial phenomena, such as solar activities and possibly supernova explosions in our galaxy, may also be embedded in their trace elements and isotopes. In order to analyze such trace ingredients in ice cores with high depth resolution and high throughput, we have developed an automated sampler of ice cores by means of a novel laser melting method.

Our new technique has some advantages as follows: 1) sampling zones are discrete to avoid mixing with each other, 2) the amount of sampling ice can be adequately minimized, and 3) fragile low-density firn cores are also applicable because the portion of an ice core block is placed horizontally on a movable stage of our system. With this new type of sampler, we will have an opportunity to perform a highly resolved, and less-loaded survey of a past long-term history of such intriguing natural phenomena.



Figure 1. Left figure shows a photo of laser-melting ice with our original nozzle intruding a dummy ice block (bottom right) and the inside sampling buffer being filled with the melted water (bottom left). The right shows our original vial filled with the melted water.