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Development of water temperature telemetry system for inaccessible and extremely acidic crater lakes

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We describe direct observation techniques for inaccessible and extremely acidic crater lakes surrounded by steep crater walls. Observation equipment and an attached weight suspended beneath a pulley are lowered to the lake surface or lake bottom under gravity along a rope stretched between opposite sides of the crater rim. The weight is tied to the observation equipment using paper string that dissolves in the lake water. This enables the rapid descent of the system from the top of the crater rim to the lake, the automatic deployment of the weight from the observation equipment once the system reaches the lake, and the simple manual retrieval of the system from the lake to the crater rim following the completion of observations. Using the above technique, we deployed two temperature telemetry buoys, including wireless thermometers, upon the crater lake of Aso volcano, Japan, to monitor water temperature. We manually ran a 400 m polypropylene rope (8 mm diameter) between opposite sides of the crater rim. The strength of the rope was sufficient to lower 375 kg of equipment to the lake surface. The protective buoy housing the wireless thermometer is made of expanded polystyrene (EPS), enabling it to float on the lake surface. The buoy has a 1-mm-thick coating of polyurethane resin to prevent UV damage. The buoys were fixed at the lake bottom using anchors and 18 m fluororesin ropes initially tied to the system using paper string, enabling the system to readily descend to the lake surface along the stretching rope. The paper strings dissolved several minutes after the equipment had landed on the lake surface, at which point the anchor descended to the lake bottom (Terada and Yoshikawa, 2009).

Keywords: crater lake, water temperature telemetry buoy, Aso volcano, hydrothermal system