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LUMINESCENCE DATING OF SAND IN BUTLER CAVE (BURNSVILLE COVE, BATH AND HIGHLAND COUNTIES, VIRGINIA) REVEALS A SEDIMENTARY RECORD FROM THE LAST GLACIATION

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Abstract:
In 2020 a sand sample from Butler Cave yielded an optically stimulated luminescence (OSL) age of 34,090 ± 3,210 calendar years (U.S. Geological Survey OSL laboratory sample BC-1). Butler Cave is located in Burnsville Cove on the east flank of Jack Mountain (a NNE-trending anticline) in Bath and Highland Counties, Virginia. Water flows down the mountain over Silurian sandstone and shale until it encounters the Silurian Tonoloway Limestone, where water enters the cave via sinkholes (many of which are clogged with sediment). The sinkholes connect to joint-controlled cave passages that descend to the east and intersect the NNE-trending cave trunk passage, which follows the axis of Sinking Creek syncline. The OSL sample was taken from part of the cave trunk passage known as Sand Canyon, which is ~250 meters (m) long, 6-8 m high, and 7-30 m wide. Under modern conditions, Sand Canyon is dry except during exceptional floods when water flows NNE through Sand Canyon to join a perennial stream named Sneaky Creek. The modern setting of Sand Canyon is an erosional landscape where very little sediment accumulates, but relict 2-3 m high terraces of sand and gravel are preserved along the passage sides. One terrace on the outside (east side) of a bend in the northern (downstream) part of Sand Canyon (where a higher-level passage leads off to the east to the Crystal Gallery) consists of a ~2 m thick unit of poorly sorted sand and gravel (mostly cobbles and pebbles), overlain by a ~0.5 m thick unit of medium sand with parallel laminations. The OSL sample was taken from this ~0.5 m thick sand.

The OSL age demonstrates that Quaternary sediments from the time of the last glaciation are preserved in caves of Burnsville Cove and can be dated by OSL methods. This site was ~300 kilometers south of the glacial front in Pennsylvania, and the coarse gravel and OSL age suggest that the terrace in Butler Cave is the deposit of a fluvial flood-pulse initiated after spring thaw breakup of ice (common in permafrost regions). The modern erosional landscape of Sand Canyon suggests that as the climate became warmer and more humid following the last glaciation, sediment influx into the cave decreased as vegetation above ground became more dense, and water (with less sediment in transport) began to excavate and remove sediment that had entered the cave during the time of the last glaciation.

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