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Quantifying Holocene relative sea-level changes and paleoclimate using the Scottish speleothem record

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Speleothems, secondary cave carbonates, are valuable archives for reconstructing paleoclimate and relative sea-level changes where the caves are in coastal locations. Unlike the typical speleothems found in carbonate caves, speleothems were recently discovered in a meta-silicate sea cave in Iona, on the west coast of Scotland. Although speleothems have previously been reported from caves in volcanic rocks, speleothems in metamorphic caves have rarely been reported. The Iona speleothems are potentially crucial because paleoclimate reconstructions spanning the Holocene are scarce in Scotland due to a lack of material, particularly speleothems, which can be dated precisely using geochemical dating methods. In this research, the U-Th and ^{14}C dating techniques will be used to constrain the precise age and growth history of the Iona speleothem. Results from pilot U-Th dating of the first speleothem sampled show it is about 1760 ~ 4780 years old (the data, however, have uncertainties up to 69.9%, due to the presence of non-authigenic Th). As for paleoclimate, oxygen isotopes indicate that the amount of precipitation was at a relatively low level between 3000 and 2000 years ago, then increased dramatically from ~2000 to 1760 years ago. These preliminary data indicate that the Iona speleothem has the potential to provide important insights into the Late Holocene relative sea-level changes and climate.