Siberian caves warn of permafrost meltdown

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Climate records captured in Siberian caves suggest 1.5 degrees of warming is enough to trigger thawing of permafrost, according to a paper to be given at the Geological Society of London on 27 June.

Permafrost regions cover 24% of the northern hemisphere land surface, and hold an estimated 17,000 Gt of organic carbon. Thawing releases CO_2 and CH_4, creating positive feedback during greenhouse warming.

The researchers, led by Gideon Henderson at the University of Oxford's Department of Earth Sciences, studied speleothem records from the caves to identify periods where temperatures were above freezing. Speleothems, such as stalactites and stalagmites, form when water seeps through cracks in cave walls, dissolving minerals which precipitate in the air filled cave.

'Cave temperatures usually approximate the local mean annual air temperature' says Anton Vaks, the paper's lead author. 'When they drop below 0 degrees, the rock above and around the cave freezes, and speleothem growth stops.'

By dating the speleothems and comparing their ages to existing climate records, it is possible to identify the degree of warming which caused the permafrost to melt. New results from Ledyanaya Lenskaya Cave, Eastern Siberia, show major deposition of speleothems at around one million years and 400,000 years ago.

'Both episodes occurred when global temperatures increased 1.5°C ± 0.5

above the pre-industrial level' says Vaks, 'showing that this degree of warming is a tipping point for continuous permafrost to start thawing.'

Global temperatures are currently around 0.7 degrees above pre-industrial level, with current models suggesting that a warming of 1.5°C ± 0.5 will be achieved within 10-30 years.

The paper will be read at the Geological Society's forthcoming William Smith Meeting, held on 25-27 June, which celebrates the 100th anniversary of the beginning of modern dating methods.

In 1913, Frederick Soddy's research on the fundamentals of radioactivity led to the discovery of 'isotopes'. Later that same year, Arthur Holmes published his now famous book 'The Age of the Earth', in which he applied this new science of radioactivity to the quantification of geologic time. Combined, these two landmark events did much to establish the field of 'isotope geochronology' – the science that underpins our knowledge of the absolute age of most Earth and extraterrestrial materials.

More information: For more information, visit:www.geolsoc.org.uk/wsmith13

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