Contribution ID: **230** Type: **Oral presentation**

KEYNOTE: Icy secrets, retreating glaciers, and the age of mountaintop glaciers

Wednesday, 5 October 2022 10:30 (30 minutes)

Alpine glaciers in the low- and mid-latitudes respond more quickly to changes in atmospheric conditions than large polar ice sheets. Many of the world's high-altitude glaciers are monitored by ground observations, aerial photography, and satellite-borne sensors. These analyses confirm that the retreat of these ice fields is persistent and driven primarily by the recent warming of the tropical troposphere and oceans. The Byrd Polar and Climate Research Center (BPCRC) has spent four decades producing and studying ice core records from the world's highest mountains. Ice cores stored in BPCRC's freezers are now being used to investigate microbes and fire histories using black carbons. Here we present ice core-derived climate records from mountains glaciers in two low-latitude regions, the central Peruvian Andes and the northwestern Tibetan Plateau. Extensive geophysical and geodetic surveys were conducted to evaluate ice thickness and deformation patterns at the drill sites on both glaciers.

In 2019 a BPCRC/Peruvian team drilled 471.6 meters of ice consisting of two cores to bedrock in the col and two cores to bedrock on the summit of the South Peak on Huascarán (Peru). The latter two cores are from the highest elevation tropical ice cap. The low temperatures at the bottom of the boreholes (-4oC col; -9oC summit) ensured that no time has been removed from the earliest parts of the records. A robust time scale extending back into the Late Glacial was developed using annual layer counting, the isotopic composition of atmospheric O2 (d18Oair), and CH4 concentrations preserved in air bubbles. Here we provide the first results of these studies that are currently underway on the Huascarán ice cores.

Ice cores drilled to bedrock from glaciers on the northern and western Tibetan Plateau have only been inaccurately or partially dated because of the low annual ice accumulation and lack of sufficient chronological control. A deep core (309 m) drilled in 1992 on the plateau of the Guliya ice cap in the western Kunlun Mountains yielded a climate record that was hypothesized to extend through the last glacial cycle and possibly beyond 500 ka based on 36Cl analysis. This timescale has been challenged by subsequent studies asserting that the Guliya record extends only to the Early Holocene. In 2015 a Third Pole Environment Program expedition redrilled the Guliya plateau to bedrock (309.7 meters) and for the first time recovered three ˜50 m cores to bedrock on the much colder summit. By utilizing a novel approach for determining d18Oair, in conjunction with annual layer counting and radiocarbon dating, we now provide robust 15 ka records of temperature variations from the Guliya cores. By matching d18Oice records between the summit and plateau cores, we confirm that the Guliya ice cap existed before the Holocene. The measurements of d18Oice and CH4 in low latitude ice cores allow us to place them on comparable times scales with polar ice cores.

Primary author: THOMPSON, Lonnie (Byrd Polar and Climate Research Center, The Ohio State University)

Co-authors: MOSLEY-THOMPSON, Ellen (Byrd Polar and Climate Research Center, The Ohio State University); SEVERINGHAUS, Jeffrey (Scripps Institution of Oceanography, University of California San Diego,); DAVIS, Mary (Byrd Polar and Climate Research Center,The Ohio State University,); BROOK, Edward (College of Oceanic and Atmospheric Sciences, Oregon State University); YAO, Tandong (Key Laboratory of Tibetan Climate Changes and Land Surface Processes, Institute of Tibetan Plateau Research); BEAUDON, Emilie (Byrd Polar and Climate Research Center, The Ohio State University); KUTUZOV, Stanislav (Institute of Geography, Russian Academy of Sciences); SCHOESSOW, Forrest (Byrd Polar and Climate Research Center, The Ohio State University)

Presenter: THOMPSON, Lonnie (Byrd Polar and Climate Research Center, The Ohio State University)

Track Classification: High-alpine ice cores