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KEYNOTE: Hunt for Earth's oldest ice - update from the Allan Hills, Antarctica

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The oldest continuous ice core record extends to only 800,000 years before present. There are compelling reasons to extend this record further. First, data from marine and terrestrial sediments show that the climate has progressively cooled over the last 5 million years and indirect evidence from ocean sediments suggests that this cooling was accompanied by a decline in carbon dioxide (CO₂). However, the uncertainties in these CO₂ reconstructions are large enough that they cannot provide robust constraints on the sensitivity of the Earth system to CO₂ levels in a warmer world, critical information for predicting future climate. Ice core samples in this time period would resolve this problem. In addition to better constraints on CO₂, ice cores older than 800,000 years would provide novel records for many other atmospheric constituents (methane, nitrous oxide, carbon monoxide, other radiatively important or biogenic gases) and novel records of the climate history of Antarctica in a warmer world.

Recent discoveries of very old (> 2,000,000 years; Yan et al., 2019) basal ice in shallow (100-200 meter) boreholes from the Allan Hills Blue Ice Area (BIA) indicate that a much longer polar ice core record of Earth's climate is within reach. In this talk I will provide an update on our research in the Allan Hills including progress on methods for dating ancient ice samples, new results from the 2019-2020 drill season, and strategies for creating paleoclimate records for stratigraphically disturbed ice. I will show that shallow coring in BIAs represent a compelling approach to extending the polar ice core record that is complementary to ongoing international efforts to drill a continuous 1.5 million-year ice core.

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