Colorado Scientific Society

2020 Annual Business Meeting and Presidential Address

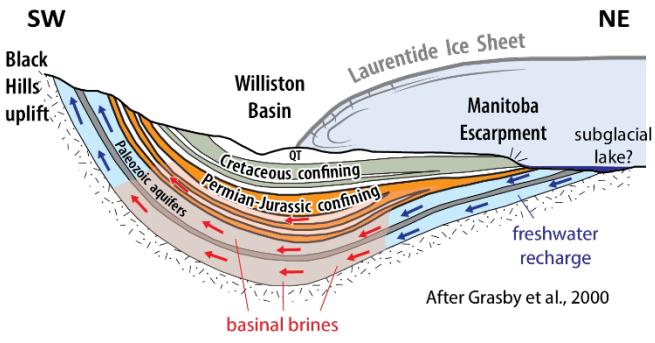
Thursday, December 17, 2020 at 7:00 pm

Online Event Only (link available at https://coloscisoc.org/ earlier that week)

Pleistocene water-table fluctuations in Black Hills aquifers linked to subglacial recharge in southern Canada? Evidence from speleothems in Wind Cave National Park

James B. Paces, Ph.D., Research Geologist, U.S. Geological Survey, Denver CO,
and 2020 President of the Colorado Scientific Society

Abstract: Phreatic speleothems in the lower levels of Wind Cave preserve a 300-ka paleohydrologic record of water-table fluctuations along the east flank of the Black Hills in South Dakota. Maximum paleo water-table high-stands were ~45 m above the modern potentiometric surface. U-series dates of wall coatings and cave rafts indicate subaerial conditions persisted to 300,000 years, after which, water-level high stands occurred during interglacial/interstadial periods and low stands occurred during full glacial/stadial periods. Values for $\delta^{18}O$, $^{87}Sr/^{86}Sr$, and $^{234}U/^{238}U$ in speleothems younger than 12 ka are consistent with compositions of modern groundwater in the cave, but older calcites have compositions more like groundwater discharging at present-day artesian springs with deeper flow paths. Data do not support previous interpretations of a monotonic water-table decline caused by local hydraulic changes. Instead, low stands reflect cold, dry conditions with little local recharge to shallow aquifers. High stands reflect reversal of regional flow in the Madison aquifer likely caused by subglacial recharge on the northeast side of the Williston Basin. Over-pressuring within the confined Madison aquifer is considered the most likely cause for increased heads in the Black Hills, even though ice-sheet advance and Wind Cave high stands were not synchronous.



James Paces is a research geologist at the U.S. Geological Survey in Denver, CO. He has used radiogenic isotopes to study a wide variety of earth processes including generation and emplacement of Midcontinent Rift magmas; age and origins of Apollo-17 mare basalts; paleohydrology of the Yucca Mtn. potential nuclear-waste repository; identification of hydrologic sources and mixing in arid wetlands; dating of early hominin sites in North America; and studies of karst evolution in several National Parks. Paces received his Bachelor of Science degree in geology from the University of Oregon in 1978, and his Ph.D. in geology from Michigan Technological University in 1988.