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Megadroughts at the dawn of Islam recorded in a 2600-year long stalagmite from Northern Oman

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Climate on the Arabian Peninsula is strongly affected by two major climate systems; the North Atlantic/Siberian pressure system in winter and the Indian monsoon in summer. Their influence is clearly discernable in the present-day precipitation pattern in Oman. Southern Oman (so-called Dhofar region) receives most of its total annual precipitation during the Indian summer monsoon (June – August), whereas northern Oman receives most precipitation during the northeast monsoon season (December – March) by southeast ward moving Mediterranean frontal system. To date, the late Holocene climatic history of Oman and the entire Arabian Peninsula is poorly understood due to the lack of well dated and highly resolved paleoclimate records. In order to fill this gap of knowledge an actively growing stalagmite (specimen H12) was collected from Hoti Cave located in northern Oman. Total annual rainfall in this area varies between 50 and 255 mm yr^{-1}, with more than 65% of total annual rainfall occurring between December and March. The chronology of stalagmite H12 is based on 22 Th-U ages, which indicate that H12 grew continuously during the last 2650 years. The H12 oxygen isotope record (δ^{18}O) is based on 1345 measurements corresponding to a temporal resolution of around 2 years. The comparison of the H12 δ^{18}O record with meteorological data reveals that δ^{18}O values reflect the amount of precipitation. The H12 δ^{18}O time series shows distinct centennial- to decadal-scale changes in the amount of precipitation. The most striking feature of the H12 isotope profile is a series of severe droughts between A.D. 500 and A.D. 1000, the most severe perennial drought is centered at around A.D. 530. During this time South Arabia experienced a series of profound societal changes, such as the collapse of the Himyarite Kingdom which was the dominant state in Arabia. Our stalagmite δ^{18}O time series from Northern Oman seems to support the hypothesis that the collapse of the 1500-year-old South Arabian civilizations and transition from the pre-Islamic to the Islamic era in the $6th$ and early $7th$ century A.D. may have been triggered by reoccurring severe droughts.