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Dertital zircon geochronology reveals Cambro-Ordovician sandstones are an environmental indicator

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Cambro-Ordovician sandstones blanketed North Africa and Arabia from the Atlantic coast to the Persian Gulf. Our literature synthesis and field studies demonstrate that this sandstone body is typically mineralogically mature, containing >95% quartz. Recent U-Pb geochronology of detrital zircons of a representative section of this Early Paleozoic quartz-rich sandstone from the Cambrian of southern Israel reveals that the section is dominated by 550-650 Ma old detrital zircons. The short time lag between consolidation of the igneous provenance and sedimentation of the eroded material indicates that in spite of their significant mineralogical maturity, the voluminous quartz-rich sandstone of north Gondwana are first-cycle sediments.

We show that the mass-production of this first-cycle quartz-rich sandstone resulted from widespread chemical weathering of Neoproterozoic (Pan-African) continental basement. Judging from the great volume of the Cambro-Ordovician sandstone they appear to represent an outstanding record of Earth's continental weathering. We infer that conditions favoring silicate weathering, namely warm and humid climate, low relief and slow sedimentation rates prevailed over large tracts of the Gondwana supercontinent in the aftermath of late Neoproterozoic Pan-African orogeny. An unusually-corrosive Cambro-Ordovician atmosphere and humid climate prevailed to enhance chemical weathering on the then vegetation-free landscape. Ocean strontium isotope ratio rose significantly at the onset of Neoproterozoic-Cambrian weathering and declined when the weathered basement was covered by the siliciclastic blanket. Thus,

detrital zircon geochronology indicates that the great Early Paleozoic sandstones of North Gondwana monitored lithosphere, athmosphere and ocean interaction, and that they are an important environmental indicator.