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Zircon ages from tectonic belts thought to represent some of the oldest (>815 Ma) units in the Arabian Shield, Saudi Arabia

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The Arabian Shield is formed by the closure and accretion of juvenile volcanic arcs and back-arc basins in which eight distinct terranes separated by five ophiolite-bearing suture zones have been isotopically and geochronologically identified. With the exception of the Paleoproterozoic (~1800–1670 Ma) Khida Terrane, these tectonostratigraphic terranes are composed of early Neoproterozoic to Cambrian (~850–530 Ma) metavolcanic, metasediment and granitoid assemblages that form an important part of Gondwana. We present the first combined U-Pb and O isotope zircon data from units in the Tayyah and Khadra Belts bordering Yemen thought to represent some of the oldest (>815 Ma) units of the Arabian Shield in order to characterize their source region. Previous studies indicate that these NE-SW and N-S trending tectonic belts, mapped as distinct units, have structural similarities, but are quite diverse in compositional and depositional facies and metamorphic grade.

SIMS U-Pb and O isotope zircon data from a volcaniclastic collected in the Atura Formation (Khadra Belt) yields detrital age peaks at 740, 673 and 642 Ma (n=137); selected magmatic zircons from each age peak produce average $\delta^{18}O$ values of 5.25 ‰ (n=14), 5.86 ‰ (n=34), and 6.0 ‰ (n=33) respectively. These values indicate that the Atura Formation is likely synorogenic, has a juvenile fingerprint (mantle-like $\delta^{18}O$ range for zircon = 5.3 ± 0.6 ‰), and the zircons were most likely derived from local volcanism during ~715 - 640 Ma eastward Shield accretion. By contrast, a quartz arenite sampled from the Sabya Formation (Tayyah Belt) yields detrital age peaks at 1050, 960, 898, 787, 719, 620, 563, and 538 Ma (n=160) with an additional 14 grains recording ages ranging from 1200–1600, 2000–2600 and 3000–3200 Ma. The $\delta^{18}O$ values of three broad age groups record increasing amounts of crustal influence through time, with >1200 Ma magmatic zircons yielding 5.68 ‰ (n=7), zircon >900 to <1200 Ma an average value of 7.02 ‰ (n=24), and <800 Ma zircon an average value of 7.42 ‰ (n=43). The significant crustal recycling recorded in the Neoproterozoic-Cambrian age grains argues against the derivation from typical juvenile Arabian Shield rocks and rather suggests that they are likely sourced from areas with more continental affinity, such as those found in Yemen or NE Africa.

A synorogenic granite dyke which cross-cuts the Tayyah Belt metasediments yields an age of 647.4 [±2.5Ma] with a $\delta^{18}O$ value of 6.13 ‰. This provides the minimum depositional age for the basin, thus creating a problem with the younger age peaks of 620, 563 and 538 Ma within the quartz arenite sample. The simplest resolution to this dilemma is if this rock is a fissure fill dyke sourced from nearby Paleozoic sandstone cover. Further work is underway to attempt to resolve this problem, after which we aim to combine measured Hf isotopes from the detrital samples and constrain their signatures to other Gondwana fragments.