Old continental crust underlying juvenile oceanic arc in northern Arabian-Nubian Shield

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The Neoproterozoic Arabian-Nubian Shield (ANS) is the best-preserved and the largest exposed Neoproterozoic juvenile crust on Earth. While the lithology and early Sr and Nd isotopic data demonstrate that the ANS crust is overwhelmingly juvenile, pre-ANS old zircons have been increasingly recognized in the ANS igneous and sedimentary rocks, casting doubt on the "juvenility" of the ANS crust. In order for a better understanding of the origin of the old continental material in the ANS and its roles in generation of juvenile oceanic arcs, we carry out an integrated in situ analysis of U-Pb age and Hf-O isotopes for zircons from the greywache and the felsic volcanic cobble samples within the Atud Formation in the Eastern Desert of northwestern part of the ANS.

Our data indicate that the Atud Formation was deposited between ca. 720 and 700 Ma, concurrent with the production of the ANS oceanic arcs. Among 110 zircon grains dated from the greywacke sample, 32 grains are older than 900 Ma, and 41 of 78 syn-ANS zircon grains give negative εHf(T) values. The Atud greywacke was most likely derived from the erosion of the proximal arc terrane that contains numerous old continental crust materials. A felsic volcanic cobble within the Atud greywacke matrixs is dated at 755 Ma. All the magmatic zircons have negative εHf(T) values, suggesting that this elsic volcanic cobble is the product generated by partial melting of old continental materials during the production of the juvenile oceanic arc. Thus the old continental crust substrate most likely underlies the ANS juvenile oceanic arcs. Our work demonstrates that the northwestern ANS is much less juvenile than previously thought. Reworking of old continental crust plays important roles in the generation of the ANS oceanic arcs.