The Age and Origin of the Western Ethiopian Shield

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ABSTRACT

Western Ethiopia is made up of a range of supra-crustal and plutonic rocks. The Precambrian exposures of the Western Ethiopian Shield are positioned within the juvenile Neoproterozoic crust of the Arabian Nubian Shield and the older, predominately gneissic Mozambique Belt (Woldemichael et al. 2010). The age and origin of the Western Ethiopian Shield are still largely unidentified. The aim of this paper is to constrain the age and origin of the sedimentary and igneous rocks within the Western Ethiopian Shield.

This will be done using isotopic techniques. The detrital zircons have been analysed for U-Pb age (yielding maximum depositional ages and age provenance information) and Hf isotopes (to investigate the nature of zircons). Geochemical analysis on the Thermal Ionisation Mass Spectrometer (TIMS), Inductively Coupled Plasma Mass Spectromentry (ICP-MS) and microprobe has also been undertaken. One of the focuses is the examination of the volcanic and volcaniclastic successions, as well as, the geochemical nature of the ultra-mafic bodies in the Shield. The geochemistry of metavolcanic and meta-volcaniclastic data suggest that the origin of the volcanics formed in an arc-like setting. Relatively low niobium; however, suggest that the mantle source may have been more enriched than that seen in modern volcanic arcs. Detrital zircons, obtained from a meta-sandstone, yielded provenance age peaks at ~2499 Ma, ~1855 Ma and between 1100-800 Ma and a maximum depositional age of 838 ± 13 Ma. Hf Isotopes from the same zircons demonstrated that both the oldest and youngest populations have broadly juvenile Hf isotopic values however; ~1820 Ma age shows significantly evolved Hf isotopic values. A minimum age constraint on the deformation was provided by the U-Pb age of 572 .6 ± 7.6 Ma and yielded whole epsilon Nd values of 3.74 and epsilon Hf values of 6.79-7.98, demonstrating a juvenile origin.
A significant aspect of the Arabian-Nubian Shield is the interpretation of the N-S oriented regional shear zones. Concentrically zoned mafic/ultramafic bodies, previously identified as remnants of the oceanic crust, are suggested to be Alaskan-type intrusions. Though chemically different to typical Alaskan-type intrusions these display a subduction affinity and have close associations to shear-zone hosted intrusions elsewhere in the Arabian Nubian Shield. Thus, they have been interpreted as being formed in similar supra subduction intrusive settings.

KEYWORDS

Western Ethiopian Shield, Geochronology, Geochemistry, Chrome Spinel

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