The Structural and Metamorphic Evolution of the Neoproterozoic Basement in Jebel Ja'alan, East Oman

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ABSTRACT

Jebel Ja'alan (east Oman) displays some of the best exposed and easternmost basement rock in the country. It comprises metasedimentary and intrusive igneous rocks, interpreted to have been generated within the Mozambique Ocean at the margin of Neoproterozoic India. The metamorphic conditions experienced by the basement and implications these conditions have for tectonic models of the region were, until now, poorly understood. The aim of this paper is to constrain these conditions in order to test the hypothesis that the basement of Jebel Ja'alan formed in a Neoproterozoic volcanic arc and unravel the relationship between the structural and metamorphic evolution of the region.

Phase equilibria modelling constrains peak metamorphic conditions to c. 670–700 °C and 4.5–6 kbar, following a clockwise *P*–*T* path. These conditions are not exclusive to an arc environment but are suggested to represent one due to current and previous interpretations of basement formation based on its geochemistry. U–Pb monazite age data of Hassan Schist samples yields a weighted average age of 833 ± 15 Ma, interpreted to be the age of near peak metamorphism, and is supported by ^{40}Ar–^{39}Ar muscovite age data, which yields a plateau age of 830 ± 6 Ma. The age data collected is shown to be older than that previously gathered for basement in the country's south and is interpreted to represent the Tonian accretion of arc terranes. Mapping of structures in Jebel Ja'alan reveals two phases of deformation, the first involving north-south directed compression, interpreted on the basis of field and petrographic observations to have occurred contemporaneous to or slightly after peak metamorphism. The second phase of deformation involved east-west directed compression, timing of this is difficult to constrain though the reported presence of similar structures within the overlying sedimentary rock suggests the deformation occurred after the Maastrichtian.

KEYWORDS

Structure; Metamorphism; Geochronology; Pseudosection; Oman; Arabian-Nubian Shield; Jebel Ja'alan; Neoproterozoic

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