Petrogenesis and tectonic significance of Neoproterozoic intrusions in Jebel Ja'alan, East Oman

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PETROGENESIS AND TECTONIC SIGNIFICANCE OF NEOPROTEROZOIC INTRUSIONS IN JEBEL JA'ALAN, EAST OMAN

IGNEOUS INTRUSIONS OF JEBEL JA'ALAN

ABSTRACT

Jebel Ja'lan, a basement inlier located in the east of the Sultanate of Oman, hosts an igneous intrusive suite. Oman lies to the south-east of the Arabian-Nubian Shield (ANS), which is a shield constructed mostly of amalgamated Neoproterozoic island arc terranes. This paper aims to calculate the age and tectonic setting of the Jebel Ja'alan intrusive suite and to understand its relationship to the ANS. The earliest intrusion of the field area, a granite batholith, is dated at ~840 Ma using U-Pb geochronology. The batholith is cross-cut by three petrologically distinct generations of dykes which have similar isotopic and geochemical signatures. All generations of the suite have positive εNd values between +0.56 to +6.78 and the granite returned positive εHf values of +2.30 to +10.17, suggesting a juvenile crustal origin. Rare earth element spider plots and tectonic classification diagrams provide evidence for an island arc setting of emplacement. Other studies of the Neoproterozoic intrusions of the ANS and the Oman basement show similar ages for island arc granite intrusions (850-830 Ma and ~845 Ma). Sm-Nd model ages of the dyke swarm of Jebel Ja'alan give Mesoproterozoic ages greater than the pre-dating granite which indicates contamination of the mantle wedge due to subduction. The dyke swarm has been interpreted from field studies and petrography to have an early stage of syn-collisional or post-tectonic emplacement, followed by a more pervasive anorogenic emplacement, possibly during extensional collapse. The Mirbat region and the arc terranes of Yemen and Sinai are cut by dyke swarms similar to Jebel Ja'alan that show island arc geochemistry and may all be coeval.

KEYWORDS

Petrogenesis; tectonics; Oman; Arabian-Nubian Shield; Gondwana; Neoproterozoic.

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