Age of the Basement to the Arabian Petroleum System: U-Pb Zircon/Apatite and In-Situ Rb-Sr LA-ICP-MS/MS Dates from Beneath Central and East Saudi Arabia

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Abstract

The Tonian to lowest Cambrian basement of Arabia (sub-Angudan unconformity) controls the palaeogeography of the early Palaeozoic, with implications of basin water chemistry, source rock maturity, reservoir quality and the location of optimally-oriented structures for subsequent reactivation. Yet the basement of Arabia between the exposed Saudi Shield, the Precambrian inliers in Oman and diapir-inclusions in the UAE has not been directly studied up until now, as it lies buried beneath thick Phanerozoic deposits. Important basement core intercepts throughout Saudi Arabia have recently been analysed using an array of established (detrital and igneous zircon and apatite U–Pb laser-ablation inductively coupled plasma mass spectrometry) and novel (Rb–Sr laser-ablation reaction-cell mass spectrometry of feldspar, mica, shale, volcanics) geochronology to understand the lithology, age, geochemistry and tectonic geography of the basement of this critical region. These data demonstrate the presence of voluminous Ediacaran volcanic rocks, volcanoclastics, siliciclastic sedimentary rocks and granitoids. All rocks have yielded Ediacaran–Cambrian ages and no evidence for pre-Neoproterozoic crust has been found in this vast area. Detrital zircon U–Pb data and detrital feldspar Rb–Sr data are used to argue for tectono- geographic relationships of these units and surrounding terranes in Arabia and beyond.

In addition to better understanding the geography of the petroleum system of Saudi Arabia, these data help elucidate the timing and nature of plate collision during the late Neoproterozoic. Previous workers have argued that the Ediacaran Jibalah Group of the Saudi Shield is an extension of the contemporary Nafun Group of Oman. Yet, other authors point out that the Jibalah rocks were deposited in an active tectonic environment that contrasts with the passive nature of the Oman margin in the Cryogenian and Ediacaran. This suggests that the final suture of the Mozambique Ocean lies somewhere beneath the exposure gap identified in the study area. We will discuss the age and nature of the rocks analysed and interpret their tectonic geographic implications for the plate tectonic evolution of Arabia and the formation of Gondwana.