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The lower crust of the Northern Arabian Shield (N Israel): Neoproterozoic sediment subduction and syn-Variscan thermal imprint from U-Pb-Hf in zircons from granulite xenoliths

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Xenoliths carried from the lower crust by basalts penetrating the Arabian lithosphere are long recognized as an invaluable source of information about the nature of the Arabian crust and its thermal history. Towards the Northern edge of the Arabian plate, where basement outcrops are covered by Phanerozoic successions, such xenoliths are the sole samplers of the continental basement. We studied the the U-Pb-Hf systematics of zircons from within mafic granulite xenoliths carried from the lower crust by pliocene basalt in North Israel, close to the late Neoproterozoic junction between the Arabian-Nubian basement to the South and the Cadomian peripheral domain exposed in the Taurides to the North. U-Pb zircon ages from the granulites vary among the different xenolith samples and cluster at 400-1200 Ma, 170-350 Ma, and 3.6-4.2 Ma, demonstrating the lower crust preserves a prolonged thermal and igneous history. While 400-550 Ma U-Pb ages are most likely the result of Pb loss, the wide scatter of zircon grains between 550-1200 Ma, alongside their diverse εHf(t) values (-25 - +10), is a remarkable evidence for the incorporation of Neoproterozoic sediments into the North Gondwana lower crust. The U-Pb-Hf signature of these zircons resembles Cadomian sediments of the Tauride block, indicating southward (present coordinates) subduction under North Gondwana and possible relamination of fore-arc sediments to the lower crust in the latest Neoproterozoic. In one xenolith, metamorphic-shaped zircons aged 170-350 Ma with positive εHf values and Hf-TDM of 0.85 Ga are interpreted to reflect Paleozoic recycling of the Neoproterozoic juvenile Arabian basement, which we consider to form a major component of the lower crust in the region. A large concentration of Carboniferous zircons (305 Ma) with exclusively negative εHf values (ca. -6) was retrieved from three xenoliths, some with igneous textures and shape. The Paleozoic age-Hf composition in our xenoliths resulted from syn-Variscan recycling of Neoproterozoic sediments in the lower crust, and some degree of melting in an un-orogenic environment. While Variscan orogeny left little igneous/metamorphic input south of Paleo-Tethys, a large-scale arch and basin geometry and widespread ‘Hercynian unconformities’ developed in the Palaeozoic across NE-Africa and Arabia, probably as a result of a mantle disturbance. The Carboniferous-aged zircons in northern Israel lower crustal xenoliths are therefore a unique gauge of the thermal perturbation that accompanied the large-scale mantle dynamics below the then-passive North African margin of Gondwana, while Variscan orogenic accretion occurred on the Eurasian margin.