Abstract Ophiolite complexes, formed in a suprasubduction zone environment during Neoproterozoic time, are widely distributed in the Eastern Desert of Egypt. Their mantle sections provide important information on the origin and tectonic history of ocean basins these complexes represent. The geochemistry and mineralogy of the mantle section of the Wizer ophiolite complex, represented by serpentinites after harzburgite containing minor dunite bodies, are presented. Presence of antigorite together with the incipient alteration of chromite and absence of chlorite suggests that serpentinization occurred in the mantle wedge above a Neoproterozoic subduction zone. Wizer peridotites have a wide range of spinel compositions. Spinel Cr# [100Cr/(Cr + Al)] decrease gradually from dunite bodies (Cr# = 81–87) and their host highly depleted harzburgites (Cr# = 67–79) to the less depleted harzburgites (Cr# = 57–63). Such decreases in mantle refractory character are accompanied by higher Al and Ti contents in bulk compositions. Estimated parental melt compositions point to an equilibration with melts of boninitic composition for the dunite bodies (TiO_2 = ~<0.07–0.22 wt%; Al_2O_3 = 9.4–10.6 wt%), boninitic-arc tholeiite for the highly depleted harzburgites (TiO_2 = <0.09–0.28 wt%; Al_2O_3 = 11.2–14.1 wt%) and more MORB-like affinities for the less depleted harzburgites (TiO_2 = ~<0.38–0.51 wt%; Al_2O_3 = 14.5–15.3 wt%). Estimated equilibrium melts are found in the overlying volcanic sequence, which shows a transitional MORB–island arc geochemical signature with a few boninitic samples. Enrichment of some chromites in TiO_2 and identification of sulfides in highly depleted peridotites imply interaction with an impregnating melt. A two-stage partial melting/melt–rock reaction model is advocated, whereby, melting of a depleted mantle source by reaction with MORB-like melts is followed by a second stage melting by interaction with melts of IAT–boninitic affinities in a suprasubduction zone environment to generate the highly depleted harzburgites and dunite bodies. The shift from MORB to island arc/boninitic affinities within the mantle lithosphere of the Wizer ophiolite sequence suggests generation in a protoarc-forearc environment. This, together with the systematic latitudinal change in composition of ophiolitic lavas in the Central Eastern Desert (CED) of Egypt from IAT–boninitic affinities to more MORB-like signature, implies that the CED could represent a disrupted forearc-arc-backarc system above a southeast-dipping subduction zone.

Keywords Pan-African · ANS · Ophiolites · Serpentinites · Spinels · Egypt