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The Chromitites Associated with the Pan-African Ophiolites in Egypt

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Ophiolites components occur in Pan-African belt in Central Eastern Desert (CED) and South Eastern Desert (SED. The ultramafic components are severely serpentinized and in some areas occur as small fresh bodies in Serpentintes. These ultramafic bodies are characterized by the harzburgite-dunite –chromite association. The ophiolite components occur as thrust sheets along suture zone or as blocks in volcano-sedimenatry mélange or as nappe as Gebel Sol-Hamed and Gebel Gerf as largest Neoproterozoic (~750 Ma) mantle rocks in SED of Arabian Nubian Shield.

The occurrences of the Neoproterozoic chromitites in Central Eastern Desert (CED), Egypt (Fig. 1) include Gabal El-Rubshi, Wadi Sodmein (Qift-Quseir road), Wadi Sephene, Wadi Beziah, Baramiya, Wadi Huitate (Idfu-Marsa Alam road), Wadi Lawi and Wadi El Zarka (South Marsa Alam). The occurrences in SED include Gebel Abu Dahar, Gebel Arais, Gebel Belmhandeit, G. Meqium, Gebel Abu Siayil, Gebel Um Thager, Gebel Gerf and Gebel Sol Hamed

Chromitite deposits occur mainly as lenticular bodies of variable dimensions in ultramafic component (serpentinites) in Pan-African belt in CED and SED, Egypt. The pods appear to be concordant to sub-concordant with the host rocks as in Wadi Sephane and Gebel Gerf (Fig. 2a, b, c, d). The pods are commonly hosted by serpentinites probably derived from dunite. There are also micro-lenses, linear and planar segregations and disseminated chromite grains in meta-peridotite as shown in Wadi El Sodmin (Fig. 2e). They contact with meta-peridotite layers, where the abundance of chromite decreases upwards. Also Away from the main body of the chromitite lens, chromitite thin layers (in the order of a few centimeters thick) also occur. Podiform chromitite usually has gradational contacts with the adjacent meta-peridotite grading up to the disseminated-type chromite (Fig. 2f).

The podiform chromitite deposits exhibit a wide range of compositions from high Cr to high Al varieties. The Cr

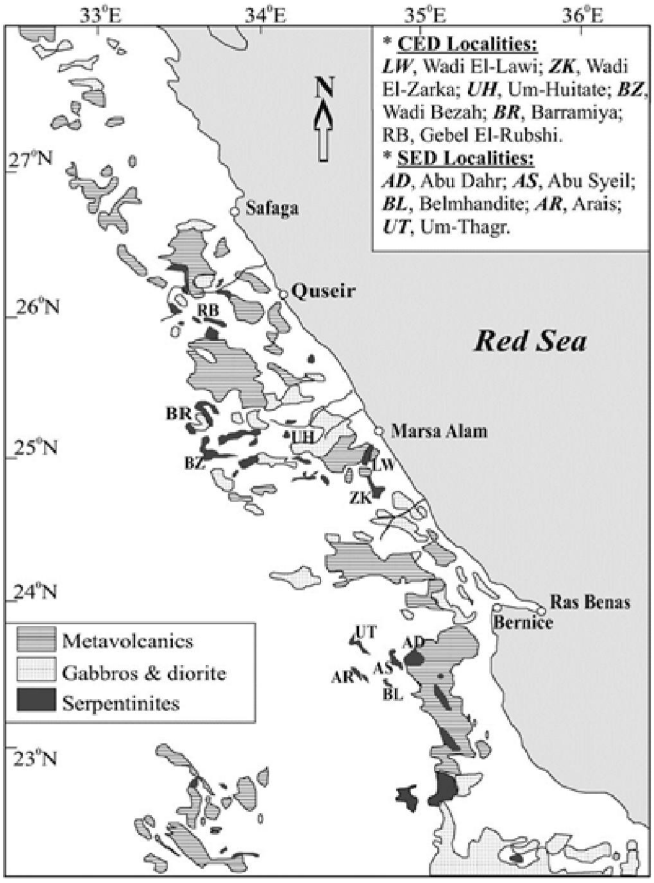

Fig. 1 Locations of Chromitites in SED and CED

of chrome spinel ranges from 0.67 to 0.88 in olivine-dunite, quite similar to that of the high-Cr chromitite, whereas it is around 0.62 in lherzolite- harzburgite (Saleh, 2006). Textural and mineralogical evidence indicates that podiform chromities were formed by crystallization of mafic magmas in the upper mantle (Lago et al., 1982). Reaction between the magmas and wall rocks is believed to have played an important role in the production of these deposits by modifying the melt composition and moving it into the field of chromite crystallization (Zhou et al., 1994, 1996). Chromite compositions are believed to be related to the degree of partial melting of host peridotites, with chrome numbers increasing as the degree of melting

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increases (Dick and Bullen, 1984). However, podiform chromitites include high-Cr (Cr_2O_3=45 wt%–60 wt%) and high-Al (Al_2O_3>25 wt%) varieties (Leblanc and Violette, 1983) and their relationship with the host rocks is not clear.

The podiform chromitite is now widely interpreted as a product of interaction between mantle harzburgite and uprising exotic basaltic melt (e.g. Arai and Yurimoto, 1994; Zhou et al., 1994; Arai and Abe, 1995; Arai, 1997a,b). Therefore, the size and composition of the podiform chromitites are strongly dependent on the chemistry of the peridotite protolith. Podiform chromitite, if present, will be very small within a highly refractory harzburgite host in which the $Cr^{\#}$ of chromian spinel is obviously high (>0.7), while it is also rare or absent within fertile lherzolite with low $Cr^{\#}$ (<0.3) of chromian spinel (Arai, 1997a). In contrast, the less refractory harzburgite with intermediate $Cr^{\#}$ (0.4–0.6) of chromian spinel is the best host for large chromitite pods

Five complexes of harzburgite–dunite–chromitite associations representing the upper mantle section of the Neoproterozoic ophiolite in the southern Eastern Desert of Egypt are petrologically investigated by Ahmed, 2013. Three complexes among them namely, Abu Dahr (AD), Abu Siayil (AS) and Arays (AR) are exceptionally fresh, while the other two localities namel, while the other two localities namely, Belamhandeit (BL) and Umm Thagar (UT) are severely serpentinized. The nature of the mantle section of these ophiolite complexes is discussed in terms of mineral chemistry and platinum-group elements (PGEs) distribution patterns. Chromian spinels in harzburgites, dunites and chromitites are very refractory with restricted chemical compositions of high-Cr varieties. The average Cr-ratio (=Cr/(Cr + Al) atomic ratio) of chromian spinel in

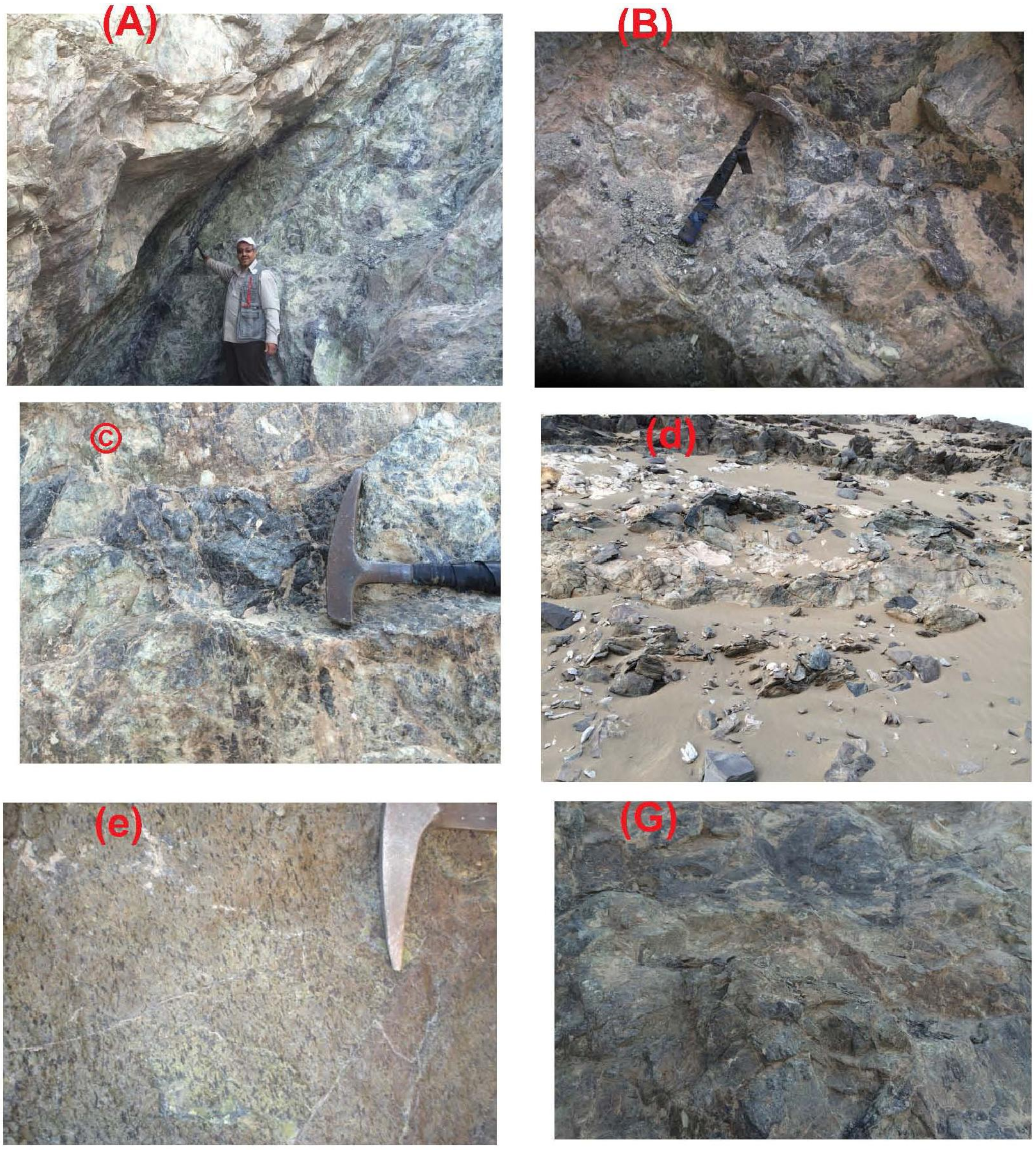

Fig.2 showing field photographs for Chromitites in Different locations the chromitites and dunite envelopes ranges from 0.76 to 0.87, while it ranges from 0.67 to 0.86 in the harzburgite hosts. The podiform chromitites with high Cr-ratio (>0.7) are predominant in fore-arc and back-arc basins setting (Arai, 1994, 1997b). The high –Cr, low Ti character of spinel in Chromitite and dunite indicates a genetic link with a supra-subduction zone setting

Platinum-group elements (PGEs) in these chromitites exhibit steep negatively sloped distribution patterns, being highly enriched in IPGEs (Os, Ir, Ru) and strongly depleted in PPGEs (Rh, Pt, Pd). Platinum-group element (PGE) mineralization has been recently reported in podiform chromitites from the late Proterozoic Pan–African ophiolite of the Eastern Desert of Egypt. The populations of platinum-group minerals (PGM) in the studied CED and SED chromitites are quite distinguishable; they are mainly sulfides (Os-rich laurite) in the former, and Os–Ir alloy in the latter (Ahmed 2007). He suggested that the diversity of PGE mineralogy combined with the differences in petrological characteristics of chromian spinels from CED chromitites to SED ones suggests different degrees of partial melting of the mantle rocks of this ophiolite which, in turn may be attributed to different tectonic settings. The Pan-African podiform chromitites may have formed in the same way as the Phanerozoic, namely by melt- harzburgite reaction and subsequent melt mixing

There is a lack in the data of Ophiolite components and associated mineralization in SED. So, I suggest that the IGCP-649 project will planning for study many areas in South Eastern Desert such as Gerf ophiolite and Zabaragad island mantle xenolith. There is no any research carried out about diamond in Egypt and lack of chromite and PGM studies. We need to study and compare the petrological characteristics and genesis of Pan-African podiform chromitites and associated ultramafics with Phanerozoic ophiolites as in Cyprus, Oman and China.

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