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Thermodynamic constraints on metamorphism of ultramafic rocks from different tectonic settings at Gebel Arais and Gebel Malo Grim, Eastern Desert, Egypt

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Here we apply to solve a set of independent reactions between minerals end-members to through light on the pressure-temperature conditions of serpentinization and regional metamorphism of the Neoproterozoic ultramafic rocks of Gebel Arais and Gebel Malo Grim, Eastern Desert, Egypt, estimating the relative timing of the rock serpentinization to the exhumation. The studied rocks include ophiolitic peridotites (spinel harzburgite and spinel lherzolite from the Gebel Arais and Gebel Malo Grim) and non-ophiolitic (intrusive-affiliated) olivine websterite (from the Gebel Arais) occurring within the ophiolitic peridotite rocks. The preliminary thermodynamic study reveals that the serpentinization process occurred in a temperature range of 250 - 450 ºC. Source of fluids, PT conditions and the environment of serpentinization of the two types of the ultramafic rocks are different (Hamdy and Lebda, 2007). The ophiolitic peridotites were mostly serpentinized after their obduction in intraoceanic setting to the West Gondwana rocks. The non-ophiolitic olivine websterites, on the other hand, were probably serpentinized before their incorporation into the obducted ophiolitic peridotites and during their cooling. This might took place in the continental mantle wedge over the subducted oceanic lithosphere. The serpentinized ultramafic rocks suffered prograde regional metamorphism during the closing of Mozambican Ocean. The peak conditions of this regional metamorphic cycle are around 500–550 ºC and 3-4.5 kbar (greenschist-amphibolite facies transition). During the exhumation process, the serpentinized rock was subjected to retrograde metamorphism with temperature around 176 to 245 ºC. The pressure of the retrograde metamorphism is difficult to be estimated due to slow kinetics at these temperatures as well as the PT slope of most reactions between mineral end-members is close to be vertical.

M. M. HAMDY and E. M. LEBDA (2007): Metamorphism of ultramafic rocks at Gebel Arais and Gebel Malo Grim, Eastern Desert, Egypt: mineralogical and O-H stable isotopic constraints. *Egyptian Journal of Geology, v. 51, 2007, p. 105- 124*