Pressure, temperature and oxygen fugacity conditions of calc-alkaline granitoids, Eastern Desert of Egypt, and tectonic implications

Abstract
Five calc-alkaline plutons; Um Tagher, Abu Zawil, Um Gidri, Um Anab and El Ghuzah, in the northern Eastern Desert of Egypt were subjected to petrographic and mineralogical investigations. They are composed of varying proportions of quartz + plagioclase + potash feldspar + biotite + hornblende ± epidote ± calcite + titanite + magn etite + apatite and zircon.

Electron microprobe analyses of coexisting hornblende and plagioclase (hornblende-plagioclase thermometry), Al content in hornblende (aluminum-in-hornblende barometry) and the assemblage titanite–magnetite–quartz were used to constrain the *P*, *T* and fO_2 during the crystallization of the parent magmas in the different plutons. The plutons crystallized under varying pressures (5.4–2.1 kbar) and wide range of temperature (785–588 °C) from highly oxidized magmas (logfO_2 −21 to −13).
The pressure data discriminate three categories of granitoid emplaced at different crustal levels: (a) upper crust granitoids (e.g., El Ghuzah, and Abu Zawil) emplaced at depths <9 km; (b) intermediate crust granitoids (e.g., Um Gidri and Um Anab) emplaced at depths <13 km; and (c) lower crust granitoids (e.g., Um Tagher) emplaced at depths <21 km. The depths of emplacement seem to increase from northwest to southeast.

It is likely that the magmas forming these plutons were generated at different depths; they were similar in composition but varied substantially in their water and volatile contents. High water and volatile contents allowed the magma of some plutons to reach shallower crustal levels without complete solidification. Although these complexes were crystallized at different depths, they were later uplifted to the same level by upward faulting.