Oxybarometric study of Closepet Granite: an anomalous sanukitoid

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The redox state of magmas affect volatiles, magmatic processes and evolution of the magma. The fO_2 conditions of the 2.5 Ga Closepet Granitoids (CG), an anomalous sanukitoid are estimated using amphibole and apatite mineral chemistry. CG amphiboles are Mg-hornblende and minor edenite with Mg/ (Mg+Fe) = 0.57-0.64 and Fe/ (Fe+Mg) =0.46-0.55. They imply crystallisation of the host CG magma at 750-830°C, 400-500MPa, 4-6.5wt% of T, P, & H_2O_{melt}, respectively. Estimates of fO_2 between ΔNNO-0.8 to ΔNNO+1.23; & ΔNNO-0.14 to ΔNNO+2.5, using formulations of Scaillet and Evans, 1999[1] & Ridolfi et al, 2010[2], respectively. Low Fe/ (Fe+Mg) of CG amphiboles also imply high fO_2. CG apatite are subhedral to anhedral, stubby with grain size 20μm-100μm. They are F-rich (>2.2-4.3 wt. %) with CaO=52.4-56.7 wt%, P_2O_5=36.4-43.7wt%, Mn=200-17406 ppm, Sr=176-717 ppm. Using the relationship between Mn in apatite and fO_2 calibrated by Miles et al, 2014 [3] we obtained logfO_2 values of -13.58 to-10.19 (ΔNNO-0.51-ΔNNO+2.16 at T=830°C, P=400MPa). Positive correlation between Th, U vs LREE values imply increasing oxygen fugacity. Chondrite normalized REE plot for apatite show negative Eu anomaly (0.2-0.77). REE slope pattern of apatite also suggest high to intermediate fO_2 conditions. Both Amphibole and Apatite mineral chemistry imply fO_2 between ΔNNO-0.14 to ΔNNO+2.5 for Closepet Granite and both water-rich and oxidizing conditions. High fO_2 & water rich conditions are the hallmark of arc setting as well as to the archean sanukitoids.

Ref: [1]. Scaillet and Evans, 1999, Journal of Petrology, 40, 381-411. [2]. Ridolfi, Renzulli & Puerini, 2010, Contrib Mineral Petrol, 160, 45-66. [3]. Miles et al., 2014, Geochimica et cosmochimica acta, 132, 101-119.