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Metamorphic Conditions Determined in the Granulites of Obudu Plateau Southeast Nigeria.

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The Obudu plateau which is part of the Trans-Saharan Orogenic Belt exposed in southeast Nigeria is underlain by diverse rock units including migmatitic gneisses, granitic gneiss, meta-ultramafic rocks and granitoids. The rocks have undergone high grade metamorphism and are Paleoproterozoic to Pan African in age. The granulites are exposed as low-lying outcrops and along stream channels to the west of the region. This study uses a combination of geothermobarometry and thermodynamic modelling to determine the metamorphic P-T conditions of the mafic (coarse grained pyroxene bearing gneiss) and pelitic (coarse grained garnet biotite migmatitic gneiss) granulites of the Obudu Plateau. The mafic granulite contains a peak metamorphic assemblage of orthopyroxene + clinopyroxene + biotite + plagioclase + ilmenite + quartz ± melt based on which a peak metamorphic condition of 4.0 -8.0 kbar and 850 - 875°C was constrained using Perple-X pseudosection modelling. For the pelitic granulite, a peak metamorphic assemblage of plagioclase + garnet + biotite + quartz + rutile + sillimanite ± melt was observed from which estimates of 796 - 844°C at 8.4 – 10.1kbar were obtained using kinetically controlled GASP and garnet-biotite thermometry. P-T modelling using pseudosections yields temperatures between 725-835°C at pressures of 7.2 - 10kbar, showing that it is possible to obtain consistent results using the two methods. Inclusions of biotite and plagioclase in garnets along with the maximum grossular content of garnet at the core (12.17 mol%) yield pressure and temperature of 10.9 kbar at 716 °C, which should lie on the prograde path. On the other hand, retrograde conditions of 3.7 - 6.1kbar and 523 - 614°C were estimated from cordierite-bearing corona assemblages of plagioclase + garnet + biotite + cordierite + ilmenite + sillimanite + quartz found at the rims of some garnets. The geothermobarometric data and pseudosection approach taken together and applied to compositions in different textural settings thus indicate a clockwise P-T path for the study area. This suggests, consistent with the known evolution of the region during the Pan African Orogeny, a continent-continent collision as the tectonic setting in which metamorphism occurred in the region.