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Geochronology and PT-estimations on garnet-hornblende-mica-plagioclase-epidote schists from the Namaqua Front, South Africa

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The Namaqua Front region comprising the Kaaien Terrane and Kheis Province is often referred to as a thin-skinned fold and thrust belt overlying the Archaean Kaapvaal Craton of South Africa. However, Humphreys et al. (1991) reported that schists of the Palaeoproterozoic Groblershoop Formation in the Kaaien Terrane had experienced metamorphic conditions between 600-700˚C and 8-11 kbar, implying a deep crustal setting. The schists which we studied contain a main mineral assemblage of grt+hbl+plag(An 17)+pheng+epi+qtz with accessory chlorite, biotite and ilmenite. The phengite contains 3.1-3.15 Si pfu and the paragonite component is 12%. The compositional range of the garnet lies between X^{Fe} 0.73–0.75, X^{Mg} 0.04–0.08, X^{Ca} 0.23–0.17 from core to rim. The oldest preserved mineral assemblage is found in garnet and hornblende inclusions, comprising quartz, epidote, ilmenite and also plagioclase in the hornblende. Retrograde chlorite and biotite postdate all other minerals. Equilibrium phase diagrams were calculated for bulk rock in the system Na2O–CaO–K2O–FeO–MgO–$Al2O_3$–SiO_2–H2O–TiO_2–O_2 (NCKFMASHTO) with the program Theriak/Domino (de Capitani, 1994). Both JUN92 (Berman, 1988) and HOPO (Holland and Powell, 1998) databases were tested and the choice of different solutions models had a large effect on the stability and composition of the different minerals. This influenced the P-T conditions under which the equilibrium assemblage is stable. The overall results suggest that garnet and hornblende growth started at 550-570˚C and 9.5-10 kbar but if the garnet and hornblende grew during a prograde path or decompression is unclear. To increase the stability of epidote a small amount of extra oxygen is added to the system. Garnet Lu-Hf ages of 1165±5 Ma reflect the age of peak metamorphism, about 40 Ma after the collision between the arc-related Areachap Terrane and the Kaapvaal Craton. At the same time (1173±12 Ma) bimodal Koras volcanic rocks were extruded at the surface (Gutzmer et al., 2000; Pettersson et al., 2007), now preserved only 20 km to the west, hardly deformed and regarded as belonging to the same tectonostratigraphic terrane. ^{40}Ar-^{39}Ar step-heating dating on both phengite and hornblende gave cooling ages of 1147±4 Ma and 1141±3 Ma respectively, reflecting the end of the Namaqua collisional orogenic cycle. The small difference between the cooling ages of phengite and hornblende argue for a rapid uplift.

Berman (1988) Journal of Petrology, 29, 445–522.

de Capitani (1994) Jahrestagung der Deutschen Mineralogischen Geselleschaft 6, 48.

Gutzmer et al. (2000) South African Journal of Geology 103, 32-37.

Holland and Powell (1998) Journal of Metamorphic, Geology, 16, 309-343.

Humphreys et al. (1991) South African Journal of Geology 94, 170-173.

Pettersson et al. (2007) Precambrian Research 158, 79-92.