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# Fluid inclusions and P-T path of Hida metamorphic rocks from Odori-gawa area, Central Japan

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We report petrological and fluid inclusion data on Hida metamorphic rocks from Odori-gawa area, Gifu Prefecture, central Japan. The major lithology of the studied area comprises mafic, granitic, and pelitic gneisses, and crystalline limestone. Metamorphic pressures and temperatures of the rocks were calculated using available geothermobarometers. The highest P-T condition was obtained from garnet-clinopyroxene rock using garnet-clinopyroxene geothermometer (Ellis and Green, 1979), garnet-clinopyroxene-plagioclase-quartz geobarometer (Moecher et al., 1988) and clinopyroxene-plagioclase geobarometer (Ellis, 1980) as 750-850 $^{o}$C, 0.9-1.2 GPa, which is the first report of high pressure metamorphism in Hida area. Nearly consistent P-T conditions were obtained from amphibolite by $Al_2O_3$ and $TiO_2$ isopleths of Ernst and Liu (1998) as 770-850 $^{o}$C and 0.8-0.5 GPa, and from garnet-hornblende gneiss and hornblende gneiss by garnet-hornblende (Graham and Powell, 1987) and hornblende-plagioclase (Holland and Blundy, 1994) geothermometers as 705-760 $^{o}$C and 750-760 $^{o}$C, respectively. Application of garnet-biotite geothermometer of Ferry and Spear (1978) for garnet-biotite gneiss yielded slightly lower temperatures of 670-730 $^{o}$C, which probably corresponds to a retrograde condition.

Fluid inclusions were observed in quartz inclusions within coarse-grained subidioblastic garnet in garnet-biotite gneiss from this area. Melting temperatures of all the analyzed fluid inclusions (-56.6 plus or minus 0.2 $^{o}$C) are close to the triple point of pure $CO_2$, although there are significant variation in homogenization temperatures (Th) from -37.0 $^{o}$C to +26.7 $^{o}$C, which translate into $CO_2$ densities of 0.683 to 1.105 g/cm$^3$. The isochore computed for the highest-density carbonic inclusions in core of garnet, which probably preserve a density of synmetamorphic fluid, shows slightly lower but nearly consistent pressure value (0.84 GPa at 800 $^{o}$C) with the peak conditions estimated by geothermobarometers. It is therefore inferred that the dominant fluid phase during the peak metamorphism was $CO_2$-rich. Our fluid inclusion study suggests a clockwise P-T trajectory for the rocks from a high-pressure stage to a granulite-facies high-temperature stage, followed by a retrograde amphibolite-facies event.