MITT.ÖSTERR.MINER.GES. 146 (2001)

THERMOBAROMETRY IN LOW-GRADE METAGRANITOIDS: HOW RELIABLE IS STILPNOMELANE ?

by

A. Piber & P. Tropper

Institut für Mineralogie und Petrographie
Universität Innsbruck, Innrain 52, A-6020 Innsbruck

This investigation is part of the ongoing project on the tectonometamorphic evolution of the Austroalpine nappes in the northern Zillertal area, Eastern Alps. The two units studied are the Kellerjochgneiss and the underlying Innsbruck Quartzphyllite. Both lithological units show a polymetamorphic evolution under low- to high greenschist facies conditions. The Kellerjochgneiss contains the mineral assemblage muscovite + biotite + albite + chlorite + quartz ± stilpnomelane. Additionally a sample from a pegmatite in the Kellerjochgneiss contains the assemblage garnet1 ($Alm_{68}Spess_{27}Pyr_3Gro_2$) + garnet2 ($Gros_{52}Alm_{33}Spess_{15}$) + biotite + stilpnomelane + muscovite + chlorite + albite + quartz. Within the Innsbruck Quartzphyllite, small greenschist layers containing the mineral assemblage albite + chlorite + muscovite + clinozoisite + sphene + calcite + stilpnomelane ± ilmenite ± biotite also occur.

Stilpnomelane ($K_{0.625}Fe_6Si_8Al(O,OH)_{27}.2\text{-}4H_2O$) occurs commonly at low temperatures (<450°C) and moderate to high pressures. In rocks containing the assemblage biotite + muscovite + chlorite + stilpnomelane + quartz, the assemblage biotite + chlorite + muscovite + quartz is used as a geothermobarometer (POWELL & EVANS, 1983; BUCHER-NURMINEN, 1987), in addition the assemblage stilpnomelane + chlorite + muscovite + quartz (CURRIE & VAN STAAL, 1999) may also yield useful information. The thermodynamic data of Fe-stilpnomelane and phengite were also included into the data base of MASSONNE (1998) and therefore can be used in multi-equilibrium calculations. These calculations were performed by calculating invariant points with the program TWQ v. 1.02 (BERMAN, 1988) and the data base of MASSONNE (1998). In addition, the empirically calibrated muscovite + chlorite + stilpnomelane + quartz thermobarometer by CURRIE & VAN STAAL (1999) was applied. These calculations yield pressures ranging from 8.3 to 9.5 kbar and temperatures ranging from 380 to 430°C for the biotite-muscovite-chlorite-quartz thermobarometer. The results achieved with the empirical thermobarometer of CURRIE & VAN STAAL (1999) are in good agreement and yield slightly lower pressures and temperatures ranging from 5.8 to 7.3 kbar and 310 to 400°C. Multi-equilibrium calculations involving Fe-stilpnomelan yield pressures of 7 - 9.5 kbar at temperatures of 310 - 350°C, which are also in good agreement with the results from the biotite-muscovite-chlorite-quartz thermobarometer. Overall, these data show that stilpnomelan can be used for thermobarometric purposes, if other P-T estimates are also available for comparison.

References

BERMAN, R. G (1988): J. Petrol. 29, 445-522.
BUCHER-NURMINNEN, K. (1987): Contr. Mineralogy and Petrol. 96, 519-522.
CURRIE, K.L. & VAN STAAL, C. R. (1999): J. Metamorphic Geol. 17, 613-620.
MASSONNE, H. J. (1998): written communication.
POWELL, R. & EVANS, J. A. (1983): J. Metamorphic Geol. 1, 331-336.