HOW DO EXPERIMENTS AND CALCULATIONS COMPARE? EXPERIMENTS VERSUS PSEUDOSECTIONS: A TEST FROM HIGH-*P*/HIGH-*T* GRANULITES AND THE ROLE OF Ti AND F IN BIOTITE

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Large bodies of Variscan felsic high-*P*/high-*T* granulites with the assemblage quartz + ternary feldspar (mesoperthite) + garnet + rutile ± kyanite occur in the Southern Bohemian Massif. They are thought to have formed at 950-1050 °C and 1.5-1.9 GPa, from granitic protoliths. In order to assess the processes of high-P/high-T granulite formation, fluid-absent piston cylinder experiments were conducted with granitic gneiss as starting material (K-feldspar + plagioclase + quartz + biotite + muscovite), whose chemical composition almost perfectly matches the main granulite type of the Southern Bohemian Massif. The experimental conditions were chosen to simulate the metamorphic P-T path determined for the granulites, with runs at 750 – 1000 °C / 1.6 GPa, (prograde path), at 950 °C / 1.4 GPa and 800 – 900 °C / 1.2 GPa (retrograde path). The experiments in the temperature range of 850 – 1000 °C all yielded the typical granulite assemblage garnet + ternary feldspar + quartz ± kyanite ± rutile. The melt-forming reaction observed in the experiments is: biotite + plagioclase + quartz = garnet + ternary feldspar + melt. At pressures of 1.6 GPa, this reaction commences at temperatures >750 °C and goes to completion between 800 °C and 850 °C. In the isobaric section at 1.6 GPa, both biotite and muscovite are present at 750 °C and 800 °C. Up to 850 °C, two feldspars are present in the experiments, albeit with a strong decrease in the modal amount of plagioclase from 18 vol.% at 750 °C to <1 vol.% at 850 °C. In runs at 900 °C and 1000 °C, Na-rich alkali feldspar is no longer stable and a K-rich alkali feldspar appears instead as the only feldspar phase. Experiments at 1.2 GPa show assemblages and textures similar to runs at 1.6 GPa with biotite being stable at 800 °C and plagioclase consumed by partial melting between 800 °C and 900 °C.

In order to compare the experimental results with theoretical predictions, pseudosections with the programs PERPLEX (CONNOLLY & PETRINI, 2002) and DOMINO (De CAPITANI & PETRAKAKIS, 2010) and the updated database of HOLLAND & POWELL (1998) were calculated. The calculated phase relations and modes are in good agreement with the experimental results. The only major discrepancy lies in the stability of biotite, which is grossly underestimated in the calculations using both programs (prediction is 100 °C lower at 1.6 and 1.2 GPa). Electron microprobe analyses showed that biotite contains up to 5 wt.% TiO_2 and 2 wt.% F. Although Ti contents can be considered empirically in Ti-biotite activity models, no biotite activity model involving F yet exists.

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