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The effect of zoned garnet on metapelite pseudosection topology and calculated metamorphic *P-T* paths

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ABSTRACT

P-T pseudosections, constructed in MnNCKFMASH and adjusted for chemical compositional changes resulting from zoned garnet growth (chemical fractionation) in a pelitic rock, show negligible changes in the position of the peak metamorphic mineral assemblage field (garnet + biotite + plagioclase + sillimanite + quartz) compared to the position of this field calculated with the bulk-rock composition. Pelitic rock samples with less than 5% modal garnet were modeled using bulk-rock chemical compositions (unfractionated), and compositions adjusted for 1, 2, and 5% garnet growth, in order to model the effects of changes in effective composition on pseudosection topology. Differences in the location of mineral mode zero lines along the garnet growth *P-T* path and in the peak mineral assemblage field are generally less than 10 °C and/or less than 0.3 kbar. However, at some *P-T* conditions, significant changes in topology are observed. For example, at pressures above 9 kbar, large temperature shifts in the zoisite mode zero line change the pseudosection topology so that biotite+zoisite stability in the pseudosection with 5% garnet fractionation has a larger temperature range (>120 °C) than in the unfractionated pseudosection (<50 °C). The effects of porphyroblast growth-induced fractionation of bulk-rock chemistry can be determined from mineral chemistry and mineral modes; pseudosections can be constructed with the adjusted chemical compositions to resolve whether fractionation affects the pseudosection topology in the *P-T* range of interest. In the case of the North Cascades samples discussed here, garnet fractionation is estimated to have minimal effects on *P-T* paths determined from pseudosections. Therefore, pseudosection modeling based on bulk-rock chemistry can be used to estimate peak metamorphic *P-T* conditions and constrain parts of metamorphic *P-T-t* paths once the effects of fractionating minerals are understood.