

P-T pseudosections and garnet isopleth geo-thermobarometry from the Malakand and Loe Sar Dome, NW Himalaya

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P–T pseudosection is a mineralogic map of stable mineral assemblages in a P–T space (White et al., 2008) and reveals complex arrangement of multivariant reactions that a rock records through metamorphism (Sayab, 2006). Pseudosections are typically constructed based on a fixed bulk XRF composition of a given rock sample. In this study, we performed calculations using latest version of THERMOCALC (ver. 3.33; Powell and Holland, 1988; updated 26 October 2009) with an internally consistent data set of Holland and Powell (1998; data set tcds55, updated 22 November 2003). The pseudosections have been constructed in the chemical system MnO-Na₂O-CaO-K₂O-FeO-MgO-Al₂O₃-SiO₂-H₂O (MnNCKFMASH). Garnet isopleths (X_{Fe} , X_{Mn} , X_{Ca}) are used for geothermobarometry. Isopleths for each of the compositional variables (X_{Fe} , X_{Mn} , X_{Ca}) are based on the electron microprobe analysis from the garnet core and plotted in divariant fields using THERMOCALC.

Sample M22 was collected close to the Malakand tunnel. The sample contains garnet, biotite and muscovite in addition to quartz and opaque minerals. The garnet core is estimated to have grown at 4.6–4.9 kbar/510–515°C (Fig. 1). The P–T estimates between garnet core and far median (inner core) regions were calculated using the intersection isopleths technique. The garnet median and inner rim regions have estimated at 5.0-5.1 kbar/522-524°C and 5.4-5.5 kbar/530-533°C, respectively (Fig.1). Sample Z23, collected from the eastern limb of the Loe Sar Dome contains garnet, biotite, muscovite and zoisite in addition to quartz. The garnet core compositional isopleths intersect at 4.0–4.1 kbar/508–511°C.

These estimates are tightly constrained and are different than those previously published in the Swat region (cf. DiPietro, 1991). Our work is in progress and we aim to link these new estimates with micro-structural (FIA: Foliation Intersection Axes) observations (see Sayab, 2006).

