American Mineralogist, Volume 88, pages 338–351, 2003

Four generations of accessory-phase growth in low-pressure migmatites from SW New Hampshire

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ABSTRACT

Mineral compositions and reaction textures found in migmatitic gneisses from near Gilsum, New Hampshire, constrain both peak metamorphic pressure (*P*) and temperature (*T*) conditions and the *P-T* path. Large K-feldspar porphyroblasts indicate isobaric heating of the samples at $P < 4$ kb (Spear et al. 1999), and relict cordierite + garnet assemblages record the occurrence of biotite vapor-absent melting; garnet-biotite thermometry yields peak temperatures of 740 °C at 3.5 kbar. During melt crystallization, low-Ti biotite + sillimanite replaced cordierite, and production of muscovite indicates $P > 4$ kb on the cooling path. Four generations of monazite have been identified, three of which have been linked to specific whole-rock reactions. Monazite (4) (the last generation) was produced with xenotime ± apatite during melt crystallization and consumption of garnet and cordierite. Monazite (3) grew in a xenotime-absent mineral assemblage as garnet + muscovite reacted to form sillimanite + biotite. Monazite (2) grew in a xenotime-bearing ± garnet + biotite + chlorite assemblage, as xenotime and chlorite were consumed during garnet production. Monazite (1) has not been linked to a specific reaction; it may be detrital, record an earlier metamorphic event, or represent disequilibrium overgrowths of xenotime. YAG-monazite, YAG-xenotime, and monazite-xenotime thermometry for monazite generations (2)–(4) yield temperatures consistent with major-phase thermometers.