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Discussion

Eclogite facies assemblages in the Adula Nappe have been well-documented in mafic and ultramafic lithologies (e.g. Trescolmen, Alp de Confin, Arbeola, Cima Lunga), but have only been reported for a few pelitic samples (e.g. Trescolmen, Zapporthorn). Alp de Confin is located within the structurally upper portion of the Adula Nappe and contains an unpublished 30m x 50m paragneiss outcrop that is progressively zoned from eclogite-facies whiteschist in the core (04AD16) to retrograde amphibolite-grade metapelites along the edges (04AD13).

Preliminary X-ray tomograph analysis of samples from different zones of this outcrop were made at the University of Lausanne to examine garnet size distributions related to the polymetamorphic history of the Adula. Statistical analyses of the tomography results indicate that an even crystal size distribution for garnet is present within the whiteschist, but that a bimodal distribution exists in the amphibolite-grade paragneisses. This shift in garnet distribution is also mirrored by a reduction in the modal proportion of garnet from ~20% in the whiteschist to <5% in amphibolite-grade samples. The change in garnet modes and crystal size distributions may be due to a reaction involving the dissolution of garnet and kyanite, but no plagioclase, staurolite or biotite (predicted by pseudosection modeling) have been observed in 04AD13 or 04AD14. Paragonite pseudomorphs after kyanite are postulated to be present in 04AD13 and 04AD14 and are also inconsistent with pseudosection modeling, which predicts the breakdown of white mica prior to the disappearance of kyanite along a decompression path.

Complicated garnet zoning patterns have been mapped via electron microprobe analysis (EMPA) in 04AD16 and 04AD15 large garnets. At least four distinct chemical zones are present within large garnets from the whiteschist samples, while the smaller garnets in the same thin sections contain only the outermost rim +/- the high Ca composition. The high-Ca composition is assumed to mark the highest pressure point along the garnet growth path, therefore the surrounding rim must have grown along the decompression path.

Meyre et al. (1997, 1999) proposed a isothermal decompression path for the middle Adula Nappe following the Trescolmen high-pressure metamorphic phase. The path was based upon mafic and pelitic assemblages from Confin, Trescolmen, Zapporthorn, and Arbeola. Engi et al. (2001) proposed a contrasting decompression path for the Adula Nappe that involves a late-stage heating event. The garnet growth following the high-pressure event demonstrated by this study argues for the latter PT path due to the topology of the garnet isopleths calculated with Theriak-Domino. However, the puzzle remains as to why the retrograde assemblage contains paragonite + quartz + phegite + garnet with no biotite, staurolite, or plagioclase as modeled by Theriak-Domino.

Future pseudosection modeling will attempt to address the inconsistencies discussed above. The addition of a melt phase to delineate the upper temperature boundary for the Confin rocks is needed. Meyre et al. (1999) chose the wet granite solidus of Huang and Wyllie (1974) for their upper temperature constraint, but this may not be the appropriate bulk composition for the Confin samples or water may not be present in excess, leading to higher melting temperatures. The pseudosections were modeled assuming water is present in excess, which may not be true. In many systems, water is driven off during the prograde path resulting in decompression paths that are water-undersaturated. The proposed breakdown of paragonite and phengite along the decompression path was suggested by Heinrich (1982) as the catalyst for retrograde reactions and used to explain the relative scarcity of pelitic eclogite-facies samples. Another issue that should be addressed in the pseudosection modeling is the inclusion of Mn and Ti. Garnet stability is increased by the presence of Mn, while the staurolite field may shrink (e.g. Tinkham et al., 2001). Ti has a similar effect for biotite, though the effects of Ti on phengite and white mica stabilities has not been explored (discussion at the THERMOCALC workshop prior to the GSA Cord. Section Meeting, April 2005).