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THE METAMORPHIC EVOLUTION OF STROMATIC MIGMATITES FROM THE WESTERN ÖTZTAL-STUBAI CRYSTALLINE BASEMENT (TYROL, EASTERN ALPS)

by

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The Austroalpine Ötztal-Stubai Crystalline Basement Complex (ÖSCB) in the Eastern Alps provides an excellent opportunity to study a metamorphic core complex which underwent several episodes of metamorphic overprints. Although extensive research has been performed on the two predominant orogenic episodes in the Eastern Alps namely the Variscan and Alpine orogenic events, very little attention has been paid to the pre-Variscan (Caledonian) metamorphic history so far. The pre-Variscan events are manifested in localized migmatite occurrences in the central and western ÖSCB. The migmatite from Verpeil in the Kaunertal, western ÖSCB, is a stromatic migmatite containing narrow (1 2 cm width) bands of leucosome. The primary mineral assemblage is garnet + biotite + plagioclase + K-feldspar + quartz ± cordierite. Cordierite is rare and subsequently breaks down to form biotite + sillimanite aggregates. Late stage muscovite also occurs and replaces biotite.

Thermobarometry and estimation of the P-T-$a(H_2O)$ conditions of the pre-Variscan metamorphic event involves application of several different thermobarometric techniques such as cation exchange thermometry (Fe-Mg exchange between garnet and biotite) and multi-phase equilibrium calculations. The latter are performed using the thermodynamic data bases and phase diagram calculation programs THERMOCALC v. 2.7 (HOLLAND & POWELL, 1998), TWQ v. 2.02 (BERMAN, 1988) and WEBINVEQ (GORDON, 1992). Our results yield temperatures of 550 - 600°C and pressures of 6 - 7 kbar and low $a(H_2O)$ of 0.2 - 0.4 for a mesosome sample. It is not clear yet, if these conditions are the final result of the pre-Variscan migmatization or the Variscan metamorphic overprint. The formation of cordierite due to the reaction biotite + sillimanite + quartz $\Leftrightarrow$ cordierite + garnet + H_2O/melt requires temperatures of at least 650 - 750°C between 3 and 6 kbar. These temperatures are high enough to induce melting as preliminary melting experiments at 700°C and 4 kbar with the natural biotite + plagioclase + quartz protolith rock show. Major element analyses of protolih rocks and adjacent mesosome samples show a decrease in SiO_2 and an increase in Al_2O_3, Fe_2O_3 and MgO during migmatization.

The thermobarometric results above will be compared to petrogenetic grids for high-grade metapelites developed by SPEAR et al. (1999). The textural observations are in accordance with an isobaric heating path above 4 kbar from the study of SPEAR et al. (1999).

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