ALPINE AND VARISCAN PRESSURE-TEMPERATURE-TIME PATHS, N-E MONT BLANC MASSIF, VALAIS, SWITZERLAND

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The Mont Chemin region, Canton Valais, Switzerland is predominantly comprised of the granitic rocks of the Mont Blanc intrusive rock suite and the Mont Blanc basement gneisses. Hosted within these rocks are a variety of sub-economic Fe-F- Zn-Pb mineral deposits and metamorphic rocks. The mineral assemblages and fluid inclusions within these rocks have been used to derive age, pressure, temperature and fluid composition constraints for a number of Variscan and Alpine events.

Metamorphic hornblendes within the assemblages from the basement amphibolites and iron skarns have been dated using 40Ar/39Ar, and indicate that these metamorphic events have a maximum age of approximately 335 Ma. Garnet-hornblende-plagioclase thermobarometry, stable isotopes, and other geothermobarometers from the basement amphibolites are consistent with metamorphic temperatures in the range 520 to 580 C, and pressures ranging from 5 to 8 kbars. Garnet-hornblende-magnetite thermobarometry and fluid inclusion studies indicate that the iron skarns formed at slightly lower temperatures of 400 to 500 C in the presence of a saline fluid at formational pressures similar to those experienced by the basement amphibolites. The earliest Alpine event is recorded in a katophorite-paragonite schist hosted within the basement gneisses. The paragonites yield a total fusion 40Ar/39Ar age of 48 Ma. Mineral thermobarometry is consistent with formational temperatures in excess of 300 C, with minimum pressures of 1500 bars. A well defined pressure-temperature uplift path is recorded in variety of overlapping Alpine events including stilpnomelane-epidote-quartz-calcite veins, quartz-chlorite veins, quartz-muscovite veins and a remobilization of the Variscan fluorite veins terminating with a gold mineralization event at a maximum age of 12 Ma (40Ar/39Ar, adularia) at temperatures in the range 240 to 300 C with pressures from 500 to 1600 bars. The overall PTt path defines a geothermal gradient of 25 C/km, but portions of this PTt path are consistent with geothermal gradients as high as 50 C/km similar to those observed to the East along the Rhone-Simplon line. Fluid inclusion and stable isotope studies indicate a diverse source of Alpine fluids, ranging from metamorphic to meteoric with considerable fluid chemistry control exercised by the local granitic wallrocks. Fluids compositions range from highly saline brines with variable K:Na:Ca to the CO2 bearing fluids typically associated with higher grade metamorphic rocks and some mesothermal gold deposits.