15 YEARS OF SILVRETTA RESEARCH: THE STATE OF THE QUESTION

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Mafic and ultramafic magmatism: Major and trace element chemistry of the Silvretta metabasites (amphibolites, eclogites) is consistent with a MORB signature. This may suggest that they are remnants of an ensialic back-arc basin, witness of a true oceanic crust or the transition between an active margin and the oceanic crust with ridge related magmatism. Unluckily, geological constraints are not enough to define the paleotectonic environment. A precise dating of this basic magmatism is lacking. Ultramafic rocks are very rare but their oceanic nature is surely established and were emplaced in the metasedimentary sequences during convergent tectonics.

Sedimentation: The Silvretta metasedimentary basement is mainly made up of paragneiss with minor semipelite and pelite. Quartzite, calc-silicate fels and marble are very subordinate. The absolute age for the deposition of these sediments is poorly constrained. U-Pb ages of detrital zircons (ca 1500 Ma) indicate an origin from a Precambrian parent rock and sedimentation during Late Proterozoic or Early Paleozoic according to most authors. Based on major and trace element discriminatory treatment the metasedimentary rocks should be related to an active continental magmatic arc with important detritus from a mature continental source, but geochemical discrimination of tectonic setting must be done with caution.

Late Proterozoic to Ordovician magmatism: The presence of an active margin is evidenced by the characteristic chemical signature of the plutonism (»Older orthogneisses«). The intrusion age of these different magmatic pulses are constrained in the time span 600–500 Ma by U-Pb evaporation and U–Pb zircon ages, giving a Late-Proterozoic minimum age of the sedimentation as well as for this subduction. The protoliths of the granitic »Younger orthogneisses« have S-type and inherited collisional signature and their Rb/Sr total rock isochrone as well as the U-Pb zircon ages clearly indicate an Ordovician (ca 460 Ma) to Silurian age . This magmatism can be described by a thermal event related to an asthenospheric mantle uplift, fast exhumation of the orogenic wedge or active margin.

Postcarboniferous magmatism: Diabase dikes have a continental, strongly differentiated tholeiitic chemistry. Isotopic evidences point to an extensive contamination by crustal materials but give no precise intrusion age. During Late Paleozoic, extensional tectonics formed graben and horst structures with contemporaneous acid volcanism.

HP event(s): The metamorphic history of the Silvretta is complex and not fully understood. It is evident that the metasedimentary pile and the embedded metabasites were metamorphosed first to amphibolite and then to HP conditions. This path is most probably related to the same subduction-collisional cycle. The main problem is if there are two or only one collisional HP events. Eclogites are found as enclaves in the »Older or-

thogneisses«. This finding can be interpreted as evidence for an old pre-intrusion HP event. The »Older orthogneisses« too show clear evidences of a HP-overprinting, which is lacking for the »Younger orthogneisses«. These Ordovician granitoids produced a contact metamorphism in eclogite rocks giving the minimum age of this HP event. Pseudomorphic structures in the country rocks of the »Older orthogneisses« are made up of garnet + kyanite + plagioclase + micas and can also be intrepreted as a HP polymetamorphic pseudomorph after contact metamorphic cordierite by the intrusion of the »Older orthogneisses«. If this is correct, the two intrusive contact metamorphisms define the maximum and minimum age for the high pressure metamorphism (in the case of only one HP event). If two events are postulated, than this would correspond to the HP II event, the HP I event being older than the »Older orthogneisses«.

Carboniferous metamorphism: After exhumation, the basement underwent a new, but short (ca 310 Ma) living cycle during Carboniferous. This metamorphism under amphibolite facies conditions is characterised by a counterclockwise path and is probably responsible for the partial reset of isotopic systems (e.g. Rb–Sr, Nd–Sm) that yields Devonian mixed ages. In the past 15 years, modern structural research has only be undertaken on a local scale.

Alpine history: A weak metamorphic overprint of questionable Alpine age was followed by a differential uplift and the detachment of the Silvretta nappe. At this time (ca 75 Ma?) pseudotachylites formed. The overtrhrust of the Silvretta nappe onto the Penninic foreland occurred about 60–55 Ma ago. Since 35 Ma, the Silvretta was uplifted relatively homogeneously.