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# The Front of the Aar Massif: A Crustal-Scale Ramp Anticline?

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The front of the Aar Massif (Swiss Central Alps) is characterized by Paleozoic basement rocks exposed at altitudes of more than 4600m above sea level, followed by a steeply north dipping Mesozoic sedimentary cover and overlying Helvetic nappes. The sediments turn into subhorizontal orientations just few kilometers to the N, where the top of the basement is situated at depths of about 7000m below sea level. What is the origin of this vertical jump of about 12000m of the basement rocks over such short horizontal distances?
Recent structural investigations at the Basement-Cover contact indicate a complex structural evolution involving reactivation of extensional faults and inversion of half-grabens during early compressional stages. In the internal parts of the Aar Massif a general steepening of the faults resulted with progressive compression. In the northern frontal part, however, a new spaced cleavage evolved, which is dipping with 20-30° to the SE. In places, the new cleavage in the basement rocks is intense and pervasive and correlates with a steepening of the basement-cover contact and its offsets of several tens to hundreds of meters. Hence strain is strongly partitioned in a large number of high strain zones, which cover a cumulative thickness of at least 2000m, eventually even much more considering subsurface continuation. The Mesozoic sediments affected by this large-scale deformation zone are either intensely ductile folded in the case of limestones or faulted and imbricated in the case of dolomites. These differences in deformation style result from the deformation conditions of about < 250-300°C, where calcite still deforms in a ductile manner, while dolomite and crystalline basement preferentially undergo brittle deformation in combination of dissolution-precipitation processes.
In a large-scale point of view, we suggest that the high strain domain in the crystalline basement in fact represents a crustal-scale several kilometers wide shear zone, which passively deforms the sedimentary cover rocks into an embryonic recumbent fold-type structure of several kilometers size. In this sense, the frontal part of the Aar massif represents a thick-skinned ramp anticline structure formed by out of sequence thrusting during a very late stage of Alpine orogeny. The latter point is corroborated by the offset of zircon fission track ages, which yield about 12 Ma suggesting latest activity along the crustal ramp surely later than that time under preferentially brittle to semi-brittle deformation conditions (< 220°C).