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TRACES OF PERMIAN TO JURASSIC BURIAL DISCRIMINATED FROM THE CRETACEOUS OROGENIC METAMORPHIC PATTERN (UPPER-AUSTROALPINE, GRAUBÜNDEN, SWITZERLAND)

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In the Permian and Triassic sediments of the Upper Austroalpine nappes high coalification and illite aggradation gradients are related to pre-Alpine burial thermal pattern. An anthracite stage of rock maturity and epizonal illite Kübler-Index (KI) values in Scythian sediments were related to a post-volcanic heating [1]. The knowledge about the age of hyperthermal heating between the Variscan and the Alpine orogeny is limited. In the last decade fingerprints of a Permian to Triassic high-temperature/low-pressure metamorphism are also find out in Austroalpine basement nappes, but the influence of aborted rifting and graben tectonics in the Triassic and rifting and crustal thinning in the Jurassic on the diagenetic to metamorphic pattern is not well known. For a better understanding of the thermal conditions between the Upper Carboniferous (Variscan exhumation) and the Late Cretaceous (Alpine nappe stacking) the Silvretta nappe in Graubünden was selected. In this unit, basement and sedimentary rocks are in a stratigraphic succession. Graben structures are filled with Permian acid volcanoclastic and ignimbrite rocks. Also in the basement Upper Carboniferous diabase/dolerite dykes are giving evidences for volcanism. Alpine metamorphism did not overprint all traces of the retrograde path of the Carboniferous andalusite-facies metamorphic peak. During the Alpine orogeny the sedimentary rocks did not exceed diagenetic to low anchizonal conditions [2]. Therefore, the burial pattern can be used to reconstruct the paleo-geothermal evolution. Only Permian to Upper Triassic sediments shows epizone metamorphism. On the basis of petrologic and geochemical studies, followed by fluid inclusion thermo-barometry P-T conditions of the metamorphism were calculated. Radiometric mica-illite model-ages and fission-track ages determine the thermal evolution of post-Variscan cooling, Permian to Jurassic burial, and Alpine orogenic heating. Coalification gradients, clay mineral aggradation gradients, and illite-smectite relations are used to fit Arrhenius type time-temperature-pressure models based on empirical or kinetic based rate equations [3,4,5]. The results indicate an increase of diagenetic grade from the Jurassic to Upper Triassic in the sedimentary section and a steep increase of metamorphism in the Carnian to Permian part. The hypothermal gradient in the Jurassic sediments is the result of Alpine diagenetic to anchizone metamorphic heating. The increase to hyperthermal gradients in the Triassic section and at the contact with the volcanic rocks was inherited from a Permo-Triassic diasthathermal event prior to nappe stacking. Mica ages of 300 to 260 Ma from the basement are giving the upper and lower limits of the Permian metamorphism. A subsequent period of varying heat flow from Permian to Jurassic times is necessary to explain the metamorphic pattern for the best fit of modelling results in the Silvretta nappe. Part of the anchi- to epizone gradient (lower stratigraphic section) was formed under steady state heat flow conditions and shows typical burial correlations between different methods [6]. The stratigraphic younger section shows high disequilibrium conditions, thus different methods used to determine grade of diagenesis give different results on diagenesis of a short orogenic event complicated by hydrothermal patterns.

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