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Geological history of the Troiseck-Floning Nappe (Austroalpine unit, Styria/Austria)

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This contribution reports LA-ICP-MS zircon ages and Rb-Sr biotite ages from the Troiseck-Floning Nappe, forming the northeasternmost extension of the Silvretta-Seckau Nappe System in the Eastern Alps. The Troiseck-Floning Nappe comprises a basement formed by the Troiseck Complex and a Permo-Triassic cover sequence. The basement consists of paragneiss with intercalations of micaschist, amphibolite and different types of orthogneiss, which was affected by a Variscan (Late Devonian) amphibolite facies metamorphic overprint. The cover sequence includes Permian clastic metasediments and metavolcanics, as well as Triassic quartzite, rauhwacke, calcitic marble and dolomite. During the Eoalpine (Cretaceous) tectonothermal event the nappe experienced deformation at lower greenschist facies conditions.

Detrital zircon grains from paragneiss are in the range of 530-590 Ma, indicating an Ediacarian to earliest Cambrian source and a Cambrian to Ordovizian deposition age of the protolith. Late Cambrian to Ordovician crystallization ages from leucogranitic intrusions represent the earliest magmatic event of the Troiseck Complex. The amphibolite bodies derived from basalt with a calcalkaline to island arc tholeiitic signature.

Leucocratic orthogneiss with K-feldspar porphyroclasts and a calc-alkaline granitic composition plots in the field of volcanic arc granite. The youngest zircon grains indicate a Late Devonian crystallization. Two pegmatite gneisses with a calc-alkaline composition are early Mississippian in age.

Mylonitic orthogneiss with a pronounced stretching lineation appears as irregularly shaped layers. It is leucocratic, very fine grained and contains scattered feldspar porphyroclasts with a round shape and a diameter of about 1 mm. Its chemical composition is granitic/rhyolitic with an alkali-calcic signature. In classification diagrams it plots in the field of syn-collision granite. Zircon ages of about 270 Ma indicate a Permian crystallization. Similar rocks interpreted as Permian rhyolitic metavolcanics appear in the cover sequence. They share a similar chemical composition and crystallization age of 270 Ma. Associated intermediate metavolcanics developed from calc-alkaline basaltic andesite.

According to Rb-Sr biotite ages cooling of the Troiseck-Floning Nappe below c. 300 °C occurred at about 85 Ma in the west and 75 Ma in the east.

In summary, the Troiseck Complex developed from Cambrian to Ordovizian clastic metasediments and granitic and basaltic magmatic rocks emplaced in the same time range. During the Late Devonian, it was affected by the Variscan collisional event, causing deformation at amphibolite facies conditions and intrusion of calc-alkaline granites. In early Mississippian time pegmatite dikes intruded, maybe induced by decompression and exhumation. The deposition of clastic sediments and (sub)volcanic rocks (rhyolite and basaltic andesite) constrains a surface position of the Troiseck Complex during the Permian. Based on regional considerations an extensional environment is assumed. In Triassic times carbonate platform sediments were deposited. During the Eo-Alpine collision in the Cretaceous the unit was part of the tectonic lower plate and subducted to shallow crustal levels, indicated by a lower greenschist facies metamorphic overprint. The Troiseck-Floning Nappe was formed and exhumed since about 85 Ma. Rb-Sr as well as apatite fission track data from the literature indicate tilting with more pronounced exhumation and erosion in the eastern part during Miocene lateral extrusion of the Eastern Alps.