Travel across the Hohe Tauern along the route from the Gail Valley to Lienz, Iselsberg, Heiligenblut, Hochtor, Bruck (Großglockner Highway), Zell am See, Kitzbühel, Kirchberg to Aschau. - A short geological route description.

(figs. 17-23)

(based on V. HÖCK, F. KOLLER and R. SEEMANN 1994 and their figures)[1]

The Alps are generally subdivided into 4 major zones which from north to south have the following names (see fig. 17):

1. Helvetikum (Helvetic Zone or Unit)
2. Penninikum (Penninic Zone or Unit)
3. Ostalpin (Austroalpine Zone or Unit)
4. Südalpin (Southalpine Zone or Unit)

Distribution and style of deformation of these 4 tectonostratigraphic zones varies in the Alps. Unit 1-3 is thrust towards the north while the Southalpine unit is south directed. In addition, it is separated from the former by the distinct Periadriatic Fault.

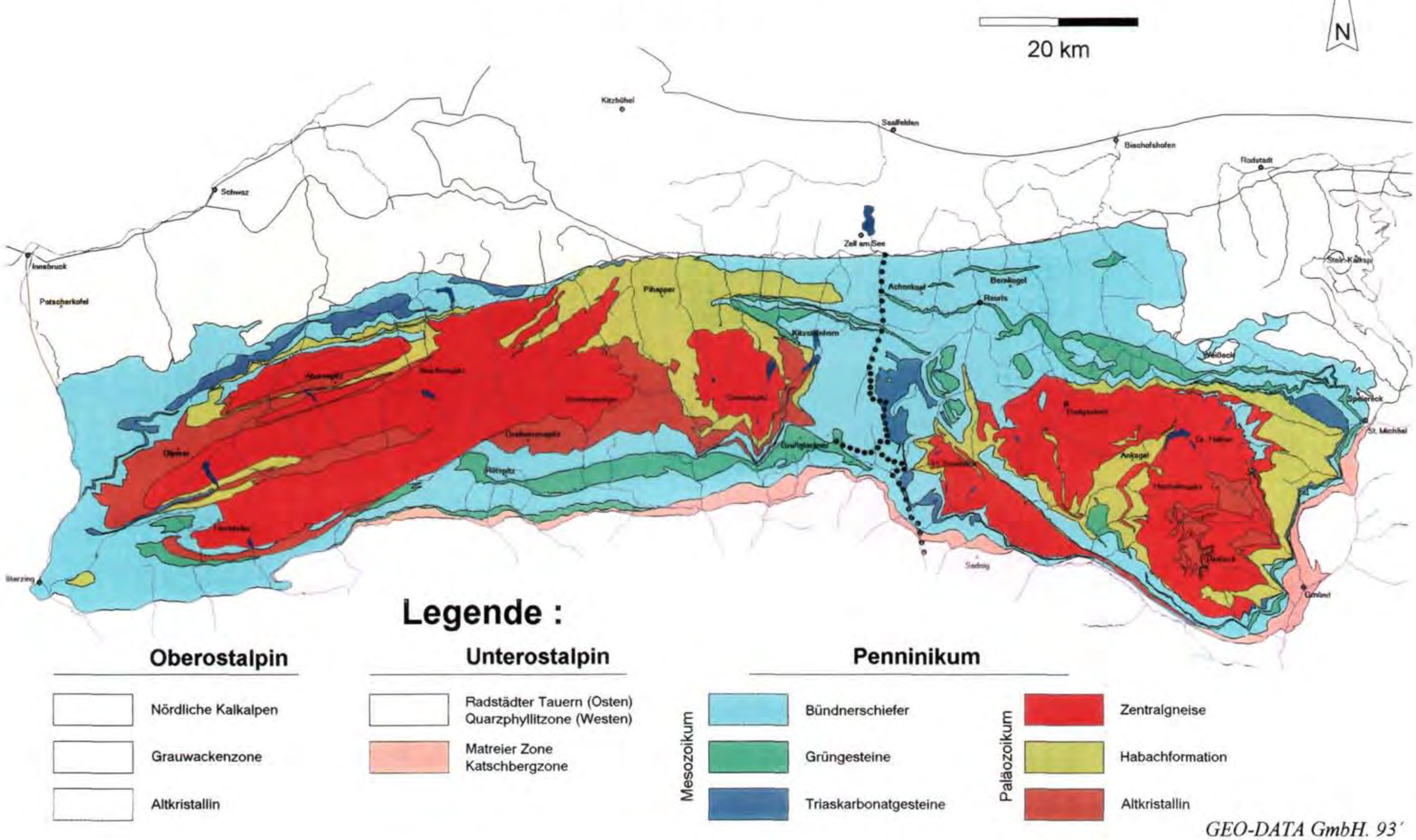
In comparison with the Western Alps in the Eastern Alps of Austria the Helvetic as well as the Penninic unit are markedly reduced. As far as the Hohe Tauern region is concerned it is surrounded by the overlying Austroalpine unit which forms a higher nappe upon the lowermost tectonic unit, i.e. the Penninic Unit (fig. 18). Due to Neogene uplifting and erosion the latter is exposed as a 120 km long and up to 60 km wide tectonic window - the so-called Tauern Window.

In the introductory part of the excursion program the evolution of the Penninic Ocean between stable Europe and the northern promontory of the Adriatic plate was outlined. Along the route from Vienna to Carinthia the main part of the Austroalpine unit was crossed. In the Hohe Tauern region the metamorphic Variscan basement rocks, the intruding late Variscan I-type-granites ("Zentralgneis") and the Permian to Mesozoic sedimentary filling of the former Penninic Ocean can be briefly shown. Due to a considerable N-S shortening and overburden all rocks have been affected by Alpine metamorphism of different ages which locally produced blueschists and even eclogites.

The Permian detritic Wustkogel Fm. is exposed along the peaks of the Großglockner Highway and represents the oldest sediments of the post-Variscan cover sequence figs. 22, 23). It grades into several 100 m thick arenaceous limestones, dolomites, rauhwackes and quartzites of Triassic age. In the Jurassic to Lower Cretaceous they were succeeded by the famous "Bündnerschiefer", a name which was introduced from

[1] HÖCK, V., KOLLER, F. & SEEMANN, R. (1994), Geologischer Werdegang der Hohen Tauern - Vom Ozean zum Hochgebirge. In: Mineral & Erz in den Hohen Tauern, p. 29-54, Naturhistorisches Museum Wien.

Fig. 17. Generalized Geological Map of the Tauern Window and its Frame
(....... Excursion Route)



their main distributional area of Graubünden in Switzerland. Lithologically, this formation can be split into three main facies each representing a different setting in the Penninic Ocean (fig. 19). They range from the arenaceous Brennkogel and Fusch facies to the marly and ophiolitic Glockner facies. The latter is characterized by the occurrences of more than 500 m thick serpentinites (harzburgites), gabbros, tholeiitic basaltic rocks and volcanoclastics which are overlain and interbedded by different sedimentary rocks.

Due to contradictory biostratigraphic and radiometric data the Paleozoic history of the Hohe Tauern is yet not clear understood. The oldest available data suggest that rock formation started in the late Proterozoic. Continuous geological processes led to a thick continental crust which was intruded by acid magmatic rocks attributed to the Variscan orogeny. The Paleozoic rock sequence comprise a vaying amount of metamorphosed clastic rocks and those which were derived from ultrabasic and acid volcanics. Metamorphosed remains of an ophilitic rock sequence associated with island-arc volcanics, and the large volume of granitic rocks may testify that plate tectonic processes were responsible for the closure of a former Paleozoic ocean and that continent-continent-collision occurred during the Variscan orogeny.

The post-Variscan transgression started at or close to the Permian/Triassic boundary by deposition of the arcosic and arenaceous Wustkogel Formation. By that time the roof of most granites was already eroded to form the basement of the succeeding Mesozoic sequences. Interestingly, the equivalents of the Triassic resemble corresponding sediments in Germany suggesting a spatial and temporal relationship with this part of stable Europe; this contrasts with sediments from the southern frame of the Hohe Tauern Window and in particular with the lithologic development of the Australpine Realm further to the south which reflects no affinity to the north.

During the Jurassic Period rifting processes and crustal thinning in cunjunction with the opening of the Atlantic Ocean led to the formation of the Penninic Ocean (figs. 19, 20). The developing basin was filled with various clastic sediments such as sandstones, arcoses, shales and breccias characterizing the Brennkogel and Fusch facies, respectively. In the course of the Jurassic a true ocanic crust was formed including a mid-oceanic ridge and ophiolitic sequences. Closure of this ocean may have started in the Cretaceous by N-S shortening and subduction processes. During this stage locally blueschists and eclogites were formed indicating high-pressure events at considerable depths. At the end of the Eocene the former ocean was definitely closed and continent-continent-collision may have ended. As the result all sediments were overprinted to a varying degree and incorporated into a north directed deformation yielding wide and partly recumbent folds of kilometer-size (fig. 21). Some 30 Ma ago the whole Penninic area was covered by the Austroalpine nappe system causing another metamorphic overprint of greenschist to amphibolite facies-grade. Finally, in the Miocene some 15 Ma ago uplift and cooling began but the former has yet not ended. Recent crustal uplift in the Hohe Tauern Region (and in general in western Austria) are in the order of 1 to 2 mm/year.

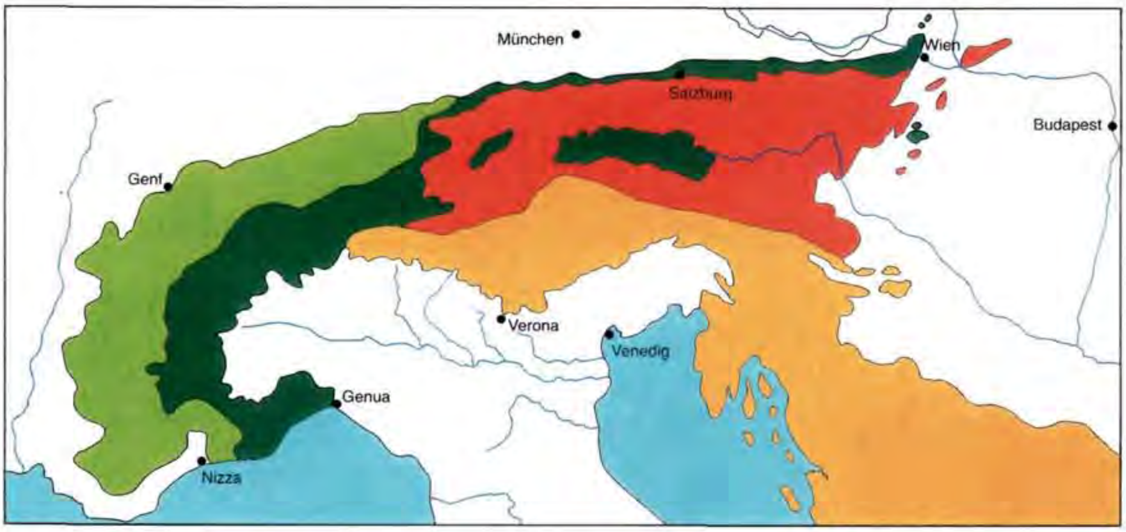


Fig. 18. Main geological subdivision of the Alps (from northwest to southeast with the Helvetic, Penninic, Austroalpine and Southalpine Zones)

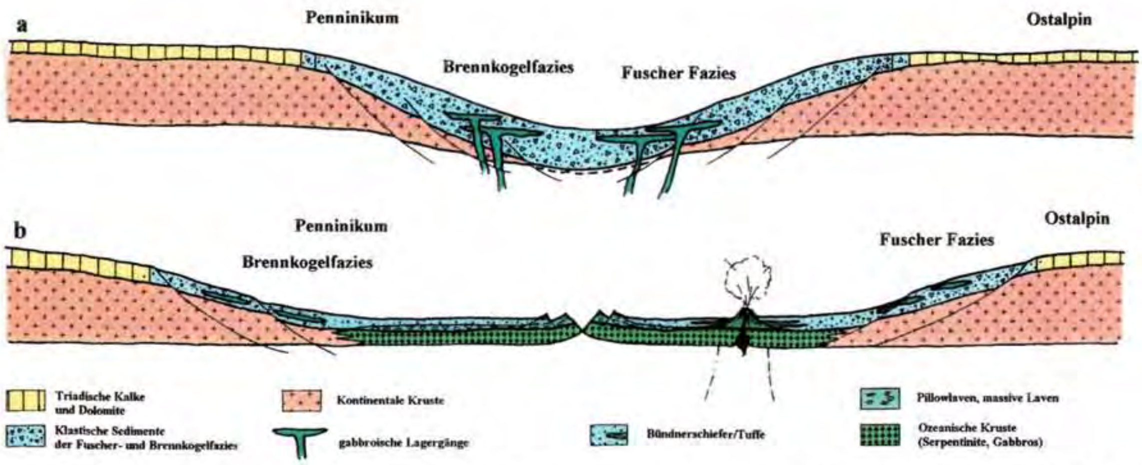


Fig. 19. Section a shows the rifting of the continental crust and opening of the Penninic Ocean at the beginning of the Jurassic with deposition of clastic sediments (Brennkogel facies and Fusch facies, respectively) with initial intrusion of basaltic dykes); section b shows the advanced oceanic stage with oceanic crust, mid-oceanic ridge and basic volcanics in the late Jurassic to early Cretaceous.

Fig. 20. Relationship between the opening of the Atlantic Ocean and the formation of the Penninic Ocean.

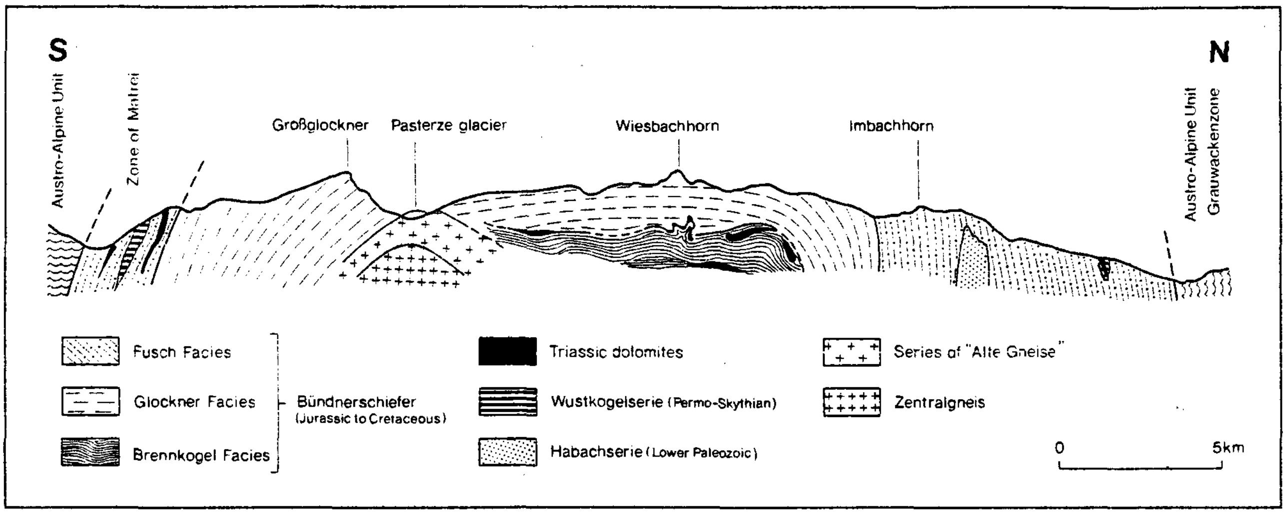


Fig. 21: Geological cross-section of the middle part of the Tauern Window after FRANK, 1965.

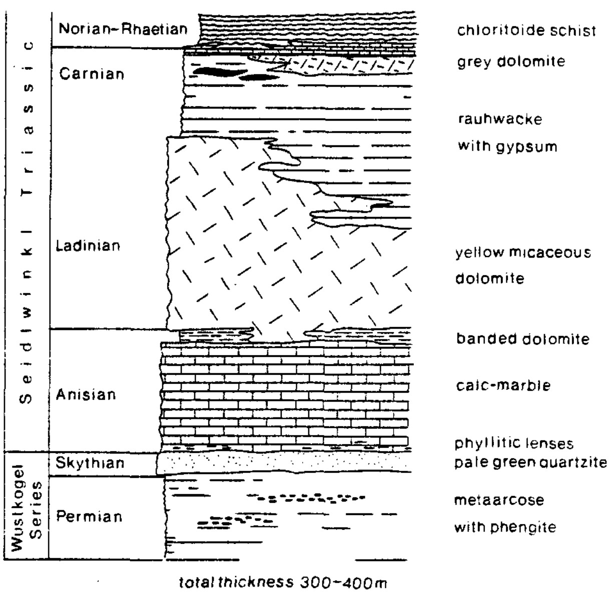


Fig. 22 (right): Columnar section of the Wustkogel Series and the Seidlwinkl Triassic (after Frank 1964).

Fig. 23 (below): Geological cross-section of the Brennkogel facies assemblage in the Hochtor area (after CORNELIUS & CLAR1993)