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THE BRENNER BASE TUNNEL – GEOLOGY AND GENERAL TECTONICS

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The proposed Brenner Base Tunnel (55 km long) crosses the complete Central Zone of the Eastern Alps. In the north, the tunnel runs through the Lower Austroalpine Innsbruck Quartzphyllitzone, which mainly consists of phyllites with varying quartz contents and interbedded calcareous and dolomitic marbles, iron-rich dolomites, greenschists, graphitic phyllites and porphyroids.

These rocks are overlain by the Tarntal Mesozoic Unit (Triassic and Jurassic) metasediments, comprising quartzites, rauhwackes (karstified evaporites), calcareous and dolomitic marbles, breccias, metasandstones, schists, radiolarites and metamorphosed ophiolites (serpentinites, ophicalcites). The Tarntal Mesozoic Unit is also imbricated with the southern Quartzphyllites. This imbrication zone is, from a geotechnical viewpoint, very difficult; in particular, the serpentinites and rauhwackes will cause problems.

From the Navis valley, the planned tunnel traverses the nappes of the Tauern Window (in our working area, up to Pfitschtal – Val di Vizze). Directly underneath the Innsbruck Quartzphyllitzone is another imbricate zone (the Matrei Zone or Nordrahmenzone). In this zone, the Bündner Schists are imbricated with numerous fragments of Permo-Mesozoic rocks (dolomites, limestones, rauhwackés, phyllites of Keuper age, quartzites and conglomerates; possibly gypsum and serpentinite may also occur). On the one hand the Nordrahmenzone could be interpreted as a tectonical imbrication zone, on the other hand these rock fragments could be interpreted as olistoliths. The northern margin of the Tauern Window and the Innsbruck Quartzphyllitzone are mostly overprinted by very tight folds with steep axial planes, with a axial planar cleavage being the dominant fabric in the rocks.

The Nordrahmenzone terminates in the slopes south of the Navis Valley, and the rocks of the Tauern Window (Obere Schieferhülle - Glockner Nappe) become more and more homogenous. The predominant lithology in the Bündner Schists are calcareous phyllites, calcareous mica schists, black phyllites and some greenschists. However, the typical Glockner Nappe rocks (in Glockner–facies) occur south of the Pfitsch Valley (Val di Vizze); these are prasinites, metamorphic ophiolites and calcareous mica schists.

At the base of the Glockner Nappe, Permo-Triassic tectonic slices (mainly quartzites and carbonates) of different thicknesses occur. In our working area, they are mainly concentrated in the Schmirn Valley (Permo-Triassic of the Schöberspitze) and west of Kematen (Caminata) in the Pfitsch Valley. The Permo-Triassic rocks of the Schöberspitze (Schmirn Valley) dip in an upright south-vergent fold to west. In the south, the Permo-Triassic rocks form the Kalkwandstange (Cma. della Stanga) are striking along (dip steeply down to south) the Pfitsch Valley. This zone, at the base of the Glockner Nappe (possibly with heavily water saturated rocks) is one of the key zones in the Base Tunnel.

The footwall rocks are the Zentralgneiss-cores (various metagranites, migmatites, light and dark dykes) and the hanging wall comprises Permo-

Mesozoic metasediments. The northern core (Tux core) and the southern core (Zillertal core) are separated by the Greiner Syncline (paragneisses, mica schists, Furtschagel Schists, amphibolites, serpentinites, talc schists, carbonate rocks, ...), which is a complex synformal structure overprinted by shear zones.

North of the Tux core and separated from it by the Hochstegen Zone, lies the tectonically lowest Zentralgneiss-core, the Ahorn core. This does not crop out in the working area, because it plunges down to the west from the Tux Valley. However, the metasediments (between Tux and Ahorn core) may appear in the planned tunnel.

The Permo-Mesozoic metasediments of the Zentralgneiss cores mainly consist of quartzites, metaconglomerates, schists (Upper Carboniferous, Permo-Skythian), Triassic carbonates (calcareous marbles, dolomites, rauhwackes), Jurassic metasediments, Liassic black quartzites, Dogger brown marbles, and Malm Hochstegen Marbles) and the Lower Cretaceous Kaserer Series. The latter is a very variably composed succession of breccias, dark quartzites, black shales, calcareous schists and calcareous phyllites. The base is characterized by the occurrence of olistoliths and/or tectonic slices (Limestones, dolostones, rauhwackes, quartzites) of different grain sizes (few centimetres to a few metres). The metasediments are divided into two parts (FRISCH 1974): the lower Hochstegen Zone and the Wolfendorn Nappe. The Hochstegen Zone are more or less autochthonous metasediments overlying the Zentralgneiss cores. Above, separated by Triassic rocks, lies the Wolfendorn Nappe, the only unit containing the Kaserer Series. This series was probably detached from the Zillertal core.

The key zones by this tunnel project (only in the working area north of the Pfitsch Valley, the investigations south of the Pfitsch Valley were made by the working group from Padova) are nappe boundaries and imbrication zones:

- between Lower Austroalpine and the Tauern window,
- the so-called Nordrahmenzone (Matrei Zone),
- the base of the Glockner Nappe with the Permo-Triassic metasediment slices,
- the metasediments of the Hochstegen Zone and the Wolfendorn Nappe,
- and the complex Pfitsch Valley Zone (Greiner syncline and shear-zone) with paragneisses, mica schists, Furtschagel Schists, amphibolites, serpentinites, talc schists, carbonate rocks.

References

FRISCH, W. (1974): Die stratigraphisch-tektonische Gliederung der Schieferhülle und die Entwicklung des penninischen Raumes im westlichen Tauernfenster (Gebiet Brenner – Gerlospass). – Mitteilungen der Geologischen Gesellschaft in Wien, 66–67, 9–20.

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