3. Road side geology - from Vienna to Hallstatt

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3.1. Bus tour Vienna - Gmunden

The Westautobahn (Highway A1) runs from Vienna, the capital of Austria, in a western direction towards the Austrian-German Border. The Highway connects from east to west the federal countries of Lower Austria, Upper Austria and Salzburg. The main cities which can be reached by the A1 are Vienna, where the Highway starts, then St. Pölten, the capital of Lower Austria, Linz, the Capital of Upper Austria and Salzburg, the capital of the federal county of Salzburg.

Tectonic overview

Geologically the A1 runs more or less parallel to the east-west striking tectonic units of the alpine orogenetic belt. Nevertheless some main tectonic units are crossed on the way from Vienna to Salzburg.
In Vienna the A1 starts at the eastern border of the Vienna Basin, then crosses the complex nappe system of the Rhenodanubian Flyschzone, which was overthrusted over the Molassezone, which is the next zone in a western direction. Then some parts of the southern Bohemian Massif are crossed including the Diendorf Fault - one of the greatest fault systems in the outer Alpine regions of Austria. From the western parts of Lower Austria onwards the A1 runs within the Molassezone. Sometimes the Flyschzone comes very close to the Highway, as well as the Northern Calcareous Alps which also are close to the highway, especially near Salzburg. For the western part of the A1, especially in Upper Austria and Salzburg, the A1 passes various accumulations (Terraces, ...) of the glaciers which existed in the Alps during the Pleistocene.
Looking at the geological units of Vienna, the capital of Austria, with an area of 414 km² 79% represent the Vienna Basin, 20% the Rhenodanubian Flyschzone and 1% the Northern Calcareous Alps (KÜPPER, 1968).

The route

The Geological Survey in the Palais Rasumofsky is situated in the Vienna Basin right at the edge of the Hochterrasse (Riß) (FUCHS, 1985). Going towards Schwarzenbergplatz, we find there the Hochstrahlbrunnen. This fountain has provided water since the emperor Franz Josef opened the „1. Wiener Hochquellenwasserleitung" which was erected based on the ideas of Eduard Sueß in the years 1870-1873. This water supply brings karst water through a 118 km long pipeline (without using any pumps!) in 16 hours from the Northern Calcareous Alps (Rax) to Vienna. Today 20.000 m³/day come to Vienna by the „1. Wiener Hochquellenwasserleitung". In 1910 the „2. Wiener Hochquellenwasserleitung" was finished, which brings another 200 Million Liters/day from the Hochschwab Area (Northern Calcareous Alps) via a 170 km long pipeline in 36 hours to Vienna.

Continuing to Karlsplatz we pass „Karlskirche". This church is dedicated to St. Karl Borromäus after the great plague in 1713. This famous baroque church with the two towers was started by Johann Bernhard Fischer von Erlach in 1716-1722, then the church was completed - after changing the dome - by his son Joseph Emanuel from 1724 to 1739. At the right side of the Curch, there is the Vienna University of Technology. At the right corner of the building, which dates back to 1816, we find the Institute of Engineering Geology. At this Institute worked among others Franz von HOCHSTETTER, Franz von TOULA, Karl TERZAGHI, Josef STINY and Franz KIESLINGER.

The Seccession at the Beginning of the Naschmarkt and the Wienzeile is an important Exhibition Hall for Contemporary Art.
The erection of its own exhibition building was one of the guiding principles of the "Association of Visual Artists Vienna Secession" that was discussed in the foundation meeting. The Secession members commissioned the hardly 30-year-old architect Joseph Maria Olbrich, who was at the time a member of Otto Wagner's atelier, to design the building, which was to become a key work of Viennese Art Nouveau. A site along the Ringstraße was originally chosen, but Olbrich's designs met with violent reaction on the part of the Municipal Council. It was only after the site was transferred to a plot on Friedrichstraße that the Municipal Council granted permission for "the erection of a provisional exhibition pavilion for the period of the next ten years" (minutes of the meeting of the Municipal Council of 17 November, 1897). The necessary financial resources for construction was partly supplied by patrons, especially the industrial magnate Karl Wittgenstein, and partly from the proceeds of the first exhibition in the k.k. Gartenbaugesellschaft (Royal and Imperial Gardening Society). The Municipality of Vienna allocated the site along the Wienzeile.
Joseph Maria Olbrich designed the building over the course of ten months, continually modifying his designs to correspond to new requirements, while reviewing and refining them at the same time. The cornerstone was laid on 28 April 1898 within the framework of a small celebration. Only six months later, on 29 October 1898, the construction was complete.
The Secession building, which is now recognised as one of the high points of any visit to Vienna, was heaped with derision at the turn of the century. The building was described as "Temple for Bullfrogs", "A Temple of the Anarchic Art Movement", a "mausoleum", a "Pharoah's Tomb", "The Grave of the Mahdi" and a "crematorium", the dome was known as "a head of cabbage", the whole building dismissed as a "a bastard between temple and warehouse" and "a cross between a greenhouse and a blast furnace".
The Secession differs fundamentally from other galleries of modern art in the way in which its program and individual exhibitions are determined. The artists elected to the board decide the program of the Secession and which artists will be invited to mount exhibitions (http://www.secession.at/).

Continuing along the Linke Wienzeile, we follow the Naschmarkt, which is the most famous market in Vienna, and we also see the stations of the metro U4 which where built by Otto Wagner. For constructing the regulation system of the Wien river he used sandstones from quarries of the Flyschzone, which were from nearby quarries.
The next prominent stop is the castle of Schönbrunn at the right side.
This castle was recently attributed to the world heritage list of the UNESCO. Two obelisks surmounted by golden eagles tower above the elaborate portal. Through its wrought-iron bars glows the yellow of Schönbrunn Palace. A first castle was owned by emperor Maximilian II. in 1559. During the invasion of the Turkish Army the castle was destroyed in 1683. In 1688 Johann Bernhard Fischer von Erlach presented a huge project according to

Versailles in France with a castle at the top of the hill. Finally he changed his plans and in 1695 to 1711 the castle was built at the actual position. Between 1695 till 1699 the garden was designed in French stile.
The Baroque style predominates on the outside of the Palace, yet the inside opens out into the world of the rocaille (the flourishes typical of the Rococo style). The decoration of the apartments is a perfect example of Austrian Rococo from the second half of the 18th century. The splendour of the rooms, which today essentially represent the taste of Empress Maria Theresia, who renewed the castle between 1744 and 1749 exceeds all expectations. After the death of her husband Franz I. in 1765 some rooms were adapted in the stile of Austrian Rococo. Between 1817 and 1819 the castle, where even Napolean lived in, was renewed again in some parts. On August the 18th 1830 Emperor Franz Joseph was born there, he lived there and died on November, 21st of 1916 also in this castle. In 1918 his son Karl I. resigned here.
In some of the rooms the Imperial predilection for the exoticism of the Far East is evident in the oriental lacquer ware, Chinese vases, porcelain and gilded paintings depicting scenes of Indian and Mogul life which dominate the rooms' splendour.
Among many attractions like the Gloriette at the top of the hill, attention should be laid on the Zoo, which was founded in 1752 as the oldest still existing Zoo of the world.
(http://www.schoenbrunn.at/e/tour/rundS00.html)

Following the indication of kilometers, which can be read on little blue signs at the right side of the Highway some points of geological interest are passed on the way from Vienna to Salzburg:

EXIT: „Auhof":
Under the alluvial deposits of the river Wien a railway tunnel has recently been built. Thus sequences of the Rhenodanubian Flysch Zone within the Kahlenberg Nappe and the St. Veit Klippen Zone are evident: grey marls of the Kahlenberg Formation (Upper Cretaceous) and variegated marls and claystones (Hütteldorf Formation, Cenomanian-Santonian)
From "Auhof" onwards the A1 runs more or less along the Hauptklippenzone. This narrow zone separates the Kahlenberg Nappe in the north from the Laab Nappe in the South.

KM 20,5: "Bihaberg":
Leaving the Hauptklippenzone and the Kahlenberg Nappe, the highway enters the Greifenstein Nappe. This is the largest nappe in the Rhenodanubian Flyschzone and can be split up in four thrust sheets ("Schuppen").
At Bihaberg the A1 cuts to the North an overturned sequence within the second "Schuppe" of the Greifenstein Nappe. The section consists of Campanian marls of the Zementmergel-serie, variegated marls and claystones of the Perneck Formation (= Oberste Bunte Schiefer") from the Upper Campanian and thick bedded sandstones of the Altlengbach Formation (Maastrichtian).

KM 27,5: "Großram":
This large outcrop to the North of the A1 is situated in the upper part of the third "Schuppe" of the Greifenstein-Nappe. It shows thick bedded sandstones of the Greifenstein Formation (Lower Eocene).

KM 43,5: Close to "Josef Weinheber-Brücke":
At Josef Weinheber Brücke, the A 1 crosses the tectonic contact between the Rhenodanubian Flyschzone in the South and the Molasse Zone in the North. The Flysch Zone

has been overthrusted upon the Molassezone during late orgenetic movements in the Lower Miocene.
This is evident by many drillings within the Flyschzone and the Northern Calcareous Alps (NCA). One important drilling is BERNDORF 1 situated in the eastern part of the Northern Calcareous Alps 35 km from the Alpine thrust front.
After penetrating the NCA the drilling reached at 5640 m a sequence of 200 m with sediments of the Rhenodanubian Flysch. At 5840 m, the overthrusting of the Molasse Zone by the Rhenodanubian Flyschzone, was documented by an Upper Oligocene Nannoflora (NP 24). Finally, at 5945 m, crystalline rocks of the Bohemian Massif were reached (SAUER et al.)

KM 53,0: Route to St. Pölten in direction S 33 to Krems:
This point at the eastern border of the Traisen Valley shows a sequence of terraces which are due to Pleistocene accumulations of the Traisen.
Following the classic ideas of PENCK and BRÜCKNER from the beginning of our century: four main levels of pleistocene fluviatile gravels (= terraces) are distinguished generally along the major rivers in the foreland:

The "Ältere Deckenschotter" (Günz),
the "Jüngere Deckenschotter" (Mindel),
the "Hochterrasse" (Riss) and
the "Niederterrasse" (Würm). Finally there is
the "Zone of recent Mäander", which reflects the Holocene.

All of them - except the "Niederterrasse" - may have thick Loess accumulations, the gravels may also be intensively weathered, so crystalline components of some older/ higher Terraces can be totally altered to Kaolin.

At the level of the "Ältere Deckenschotter" there is a panoramic view:
In a southern direction the hilly landscape is part of the Flyschzone, whereas the horizon is part of the Northern Calcareous Alps. In the north the Dunkelsteiner Wald as a part of the Bohemian Massif is visible.

KM 55,0: "Hochterrasse" of the Traisen-Valley:
Coming down from the level of the "Ältere Deckenschotter" the wide area of the "Hochterrasse" is passed, which was deposited during the Pleistocene (Riss). The material of the terrace consists of sandy gravels derived from the Northern Calcareous Alps and - to some extent - by the Rhenodanubian Flysch Zone.

KM 56,0: "Niederterrasse" of the Traisen-Valley:
The next lower part of the terraces are the gravels of the "Niederterrasse" (Würm) which are also dominated by material from the Northern Calcareous Alps.

The skyline of St. Pölten shows the tower of a baroque church as well as the so called "Klangturm" which is in the Center of the recently built Center of the government of Lower Austria. St. Pölten is so far the youngest capital in Austria. Since an election in 1986 Vienna was the Capitel of Austria, of Lower Austria and an autonomous Federal Country. After the peoples decision in 1986 all institutions of the government of Lower Austria went to St. Pölten, after a totally new governmental Center was built.

KM 58,0: View to "Muckenkogel" (1248 m):
The Muckenkogel (1248m) south of Lilienfeld within the Northern Calcareous Alps is the place where skiing began in Austria. On the 19th of March 1905 the first down-hill slalom in the world with 24 men and women was organised by Mathias Zdarsky (1856-1940), the

pioneer of alpine skiing. Later on he organised a lot of courses to make skiing more popular, among the participants were also earth scientists such as Julius v. Pia (1875-1947).

KM 59,0: "Schlier":
The route up the hill brings us from the Pleistocene reformed depression of the Traisen to the "Jüngeren Schlier", which is covered here (KM 60,5 - 61,5) by the "Ältere Deckenschotter" which forms the wide plain north of the highway.
"Schlier" is a common word for pelitic sediments of the Molassezone, which were deposited during the Oligocene and the Miocene. Following a rough classification which was established by mapping geologists at the beginning of our century, "Schlier" may be divided into "Älterer Schlier" (= older Schlier) which is a brown clay to silt of Oligocene age and into the "Jüngeren Schlier" (= younger Schlier), which is grey, more sandy and of Miocene age.

Raststation St. Pölten: View to the Ötscher (1893 m):
From the position of the "Raststation St. Pölten", still at the level of the "Ältere Deckenschotter", there is an excellent view to the south towards the Ötscher (1893 m). The Ötscher is situated within the Northern Calcareous Alps. The peak of the Ötscher consists of Upper Triassic Dachstein Kalk and Dachstein Dolomite (BAUER & SCHNABEL, 1997).

KM 64,0: Pielach Valley:
In the Pielach Valley there is the same sequence of pleistocene deposits as in the Traisen: First we follow the "Niederterrasse", then from Km 65,5 till 66,0 the "Hochterrasse". Older Pleistocene deposits are eroded and so are evident only in small relictic areas.

KM 73,0: View to the north to "Lochau":
Some outcrops at the "Lochau" show a miocene olisthostrome which is intercalated in the "Schlier". Components are derived from the Bohemian Massiv in the North.

KM 76,5: View to the Wachberg (300 m):
The Wachberg shows a distinct plateau at the top (300 m) which is covered by gravels of the Danube during the pleistocene. In this region FUCHS established in 1964 for the first time a detailed sequence of terraces of the Danube (Fig. 3. ?).

The basis of this „Wachberg-level" sensu FUCHS is at 285-290 m. The gravels of this terrace are rich with quartz (apx. 70%) and crystalline components (30%), most of them are weathered; there are no carbonates (BUCHHAMMER, 1989).

KM 77,5: View to the south: Schallaburg:
The Schallaburg is the most famous castle in Lower Austria in the style of the renaissance. It was built in this style in 1572 from a medieval castle, then after heavy bombing during the Second World War, it was totally restored in 1974. Now the Schallaburg hosts many great exhibitions.

KM 80,0: Sandpit of "Melker Sande", Stift Melk:
At the western part of the Wachberg there is a great sand pit within the "Melker Sande" which could be traced within the whole Wachberg.

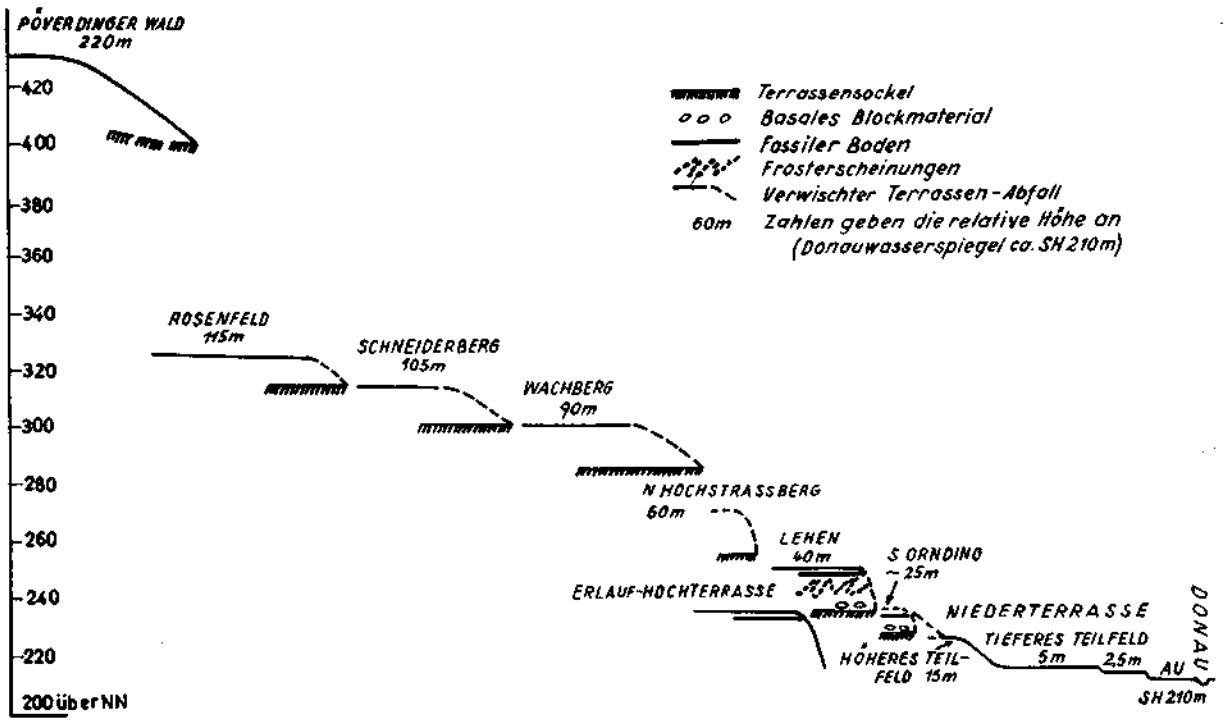

Fig. 3.1.1.: Sequence of Terraces in the Region of Melk (from FUCHS, 1964).

The white Melk Sands are according to ROETZEL (1983), deposited in the wash zone to breaker zone. The spectrum of heavy minerals points to a transport of the sediments from the Bohemian Massif. The poor roundness of the grains makes a short distance of transport probable. Heavy minerals and feldspar seem to be partly influenced by presedimentary weathering processes and the climatic changes from early Oligocene to Middle Oligocene.
The Melk Sands are pure quartz-sands used for the glass industry in nearby Pöchlarn. During late Oligocene and early Miocene the south eastern part of the Bohemian Massif was a wide coastal area with many bays. Due to the changing sea-level we find brackish sediments with coal horizons (Pielach Clays) at the Lower Oligocene, as transgression proceeds coastal sands (Melk Sands) are deposited. Later on - in the lowest Egerian - a regression with the deposition of lagoonal sediments takes place. During the following new transgression reworked coarse sands were deposited on submarine sandbars in the transition zone. In protected nearshore areas the sedimentation of fine coastal sand continues. In the Late Oligocene the deposition of shelf sediments starts with the deposition of „Älterer Schlier", which covers the sequence.

The monastery of Melk is one of the most prominent buildings of baroque style in Europe. It is built on cristalline rock (schists). The building with its 362 m long front and 1188 windows was erected in the period of 1702-1726 according to the plans of Jakob Prandtauer. The monastery is still inhabited by benedictine monks, and is very famous for the rich library (more than 80.000 books, and 1850 handwritten books and documents). Inside, the church and the monastery is decorated with colourful, baroque frescos.

The town of Melk also marks the southern end of the Wachau area which extends to Krems. This 30 km long valley of the Danube is famous for its beautiful landscape, fine wine (since Roman times) and apricots. The latter products of the Wachau can be found in the eastern part and reflect the mild climate. Geologically the Wachau follows to a large extent the Diendorf Fault, a southwest - northeast striking fault. The eastern part of the Wachau is wider and was a bay of the Paratethys during the Middle Miocene.

KM 83,5-84,0: Diendorfer Fault and Hiesberg (558 m):
The river Melk here follows strictly the Diendorf fault. The sinistral NE-SW-striking Diendorf fault dissects the basement into two blocks which are displaced by up to 25 km. Before these movements the granulite Masses of Pöchlarn - Wieselburg in the west and of the Dunkelsteinerwald in the east formed a unit.
The Hiesberg (558 m) in the south is mainly formed by steeply inclined N-S striking paragneisses with intercalations of migmatitic granite gneisses and amphibolites. The coarse grained Zelking Granit is identical with the Weinsberg Granite of the South Bohemian Pluton in the Moldanubian Unit of the Bohemian Massif. (MATURA, 1984)

KM 90,0: Pöchlarn: View to the North:
At the edge of the northern side of the Valley of the Danube, there is the Church of "Maria Taferl" at 443 m. This baroque church was built between 1660 and 1710. It is visited every year by 250.000 to 300.000 pilgrims.

KM 91,5 - 92,0: View to Pleistocene terraces of the Danube:
According to Werner FUCHS (1964) the lower terrace belongs to the „Niederterrasse", whereas the upper one is attributed to the „Hochterrasse".

KM 93,5 - 94,0: Granulite of the Bohemian Massif:
The granulite belongs to the Moldanubian zone in the Bohemian Massif. This zone is divided into three main lithological units (from bottom to top):

the Monotone (= Monotonous) Series,
the Bunte Series (= Variegated) and
the Gföhl Unit.

The latter is predominantly composed of amphibolites, the widespread Gföhl gneiss and granulite. The granulite forms tectonically emplaced klippen such as the Dunkelsteiner Wald at the top of the Moldanubian zone. The granulite comprises pyroxene-free assemblages, which are in a few places intercalated with pyroxene bearing rocks. Kyanite is a common relict phase, either enclosed in garnet or transformed laterally to sillimanite in the rock matrix. The protolith of the pyroxene-free granulite was an acid igneous rock that crystallized close to the wet-granite minimum whereas the less acidic, pyroxene-bearing granulite is most probabley derived from calcalkaline magmatic differentiates (PETRAKAKIS, 1997).

KM 98,0: View to the North to the "Loja-Quarry":
This quarry is situated in a small, apx. 100 m wide slice of the Bunte (= Variegated) Series. Dominating rocks in the quarrry are graphitic schists, garnet rich amphibolites and marbles, which show reaction zones with paragneisses. The whole series of rocks is penetrated by discordant dykes.

KM 99,5: View to the North "Power-station of YBBS":
This power-station was the first of nine powerstations on the Austrian part of the Danube. It was built between 1959 - 1964.

EXIT: „AMSTETTEN OST":
At the northern side of the highway the crystalline of the Bohemian Massif occurs once again.

KM 109,0 - 146,5: Landscape:
Following the route in an eastern direction we pass the so called „Strengberger Hügelland": This hilly landscape is characterised by individual farmhouses („Vierkant-höfe"). We typically find apple and pear trees around the houses. The fruits are used to produce "Most", which has a low content of alcohol and may be to some extent compared to the British "cider".
Geologically the landscape is built of "Schlier" (both types) which is covered by intensively weathered layers of early Pleistocene gravels ("Ältere Deckenschotter") and loess.

KM 146,5: "Schlier":
We cross the contact between the "Älteren" and "Jüngeren Schlier"

KM 149,5: Enns-valley:
We are at the "Niederterrasse" (Riss) of the Enns river. This level is according to VAN HUSEN (1971), divided into three levels (Obere Niederterrasse, Untere Niederterrasse and Oberes Hochflutfeld), which corresponds to the terraces of the Danube.
The River Enns, 254 km with ist source in Salzburg, enters Styria through the east-west striking "Ennstal" which follows one of the major tectonic faults in the Eastern Alps.

EXIT: "ENNS":
The town of Enns with its distinctive Tower (59 m, built between 1564-68) is situated on the „Hochterrasse" and dates back to Roman times ("Lauriacum"). Here the "Hochterrasse" (Riss) begins and continues till KM 157,5, where the level of "Niederterrasse" begins again.

KM 163,0: View to the „VOEST"
Here we have an overview of the steel industry of Linz, which is known as „VOEST" or - in full name VOEST-ALPINE STAHL LINZ GmbH (http://www.voest.co.at)

Turnover:	ATS 19.762 million
Delivered volume:	3,290,000 metric tons flat rolled steel products, 3,345 metric tons smith hammer forming and forming work pieces, 5,111 metric tons boiler bottoms.
Employees:	7,917.

Short history of the „VOEST":
1945: Eisen- und Stahlwerke Österreichs" (United Austrian Iron and Steel Works) During the same year the company changed its name to "Vereinigte Österreichische Eisen- und Stahlwerke AG" (VÖEST) (United Austrian Iron and Steel Works, Inc.)
1946: Resolution of the 1st Nationalization Law: Nationalization of VÖEST.
1947: 1st Blast Furnace (No. 5) of VÖEST is started up , Blast furnace bricked, 1st Open-hearth furnace in the steel works is started up.
1948: Blast Furnace No. 3 and 4 are started up, Thin sheet rolling mill becomes operational.
1955: The annual production of pig iron in the 3-Blast-Furnace operation reaches one million metric tons for the first time.
1970 : The start-up of a Sendzimir-4 Roll-Cold Rolling Stand makes the production of very thin sheets possible. The 4-Blast Furnace Operation surpasses an annual production of two million metric tons of pig iron.
1992. Inauguration of Europe's most modern plate testing center in Linz.

1995: In preparation for the listing of the share on the stock exchange, VOEST-ALPINE STAHL AG restructures its portfolio, in some areas extensively, by spinning-off areas of the Group of companies that are not part of the Group's core activities;, among other events, VOEST-ALPINE STAHL JUDENBURG GmbH was sold as well as the majority interest in VOEST-ALPINE INTERTRADING AG.

1997: As a part of the ATS 11 billion capital investment program, the new continuous casting line CC 5 of the Linz steel plant with an annual capacity of 1.2 million metric tons is started up in February. In April the first phase of the expansion of the hot dip galvanization plant 2 Linz is completed on schedule, capacity increases from 240,000 metric tons annually to 280,000 metric tons annually. The final expansion to 350,000 metric tons annually is scheduled for 1998. In the middle of the year, the production plant for laser welded sheet bars is started up. An annual production of approximately 1.1 million steel sheet bars for the automobile industry is scheduled. The wide strip mill in Linz is further modernized extensively.

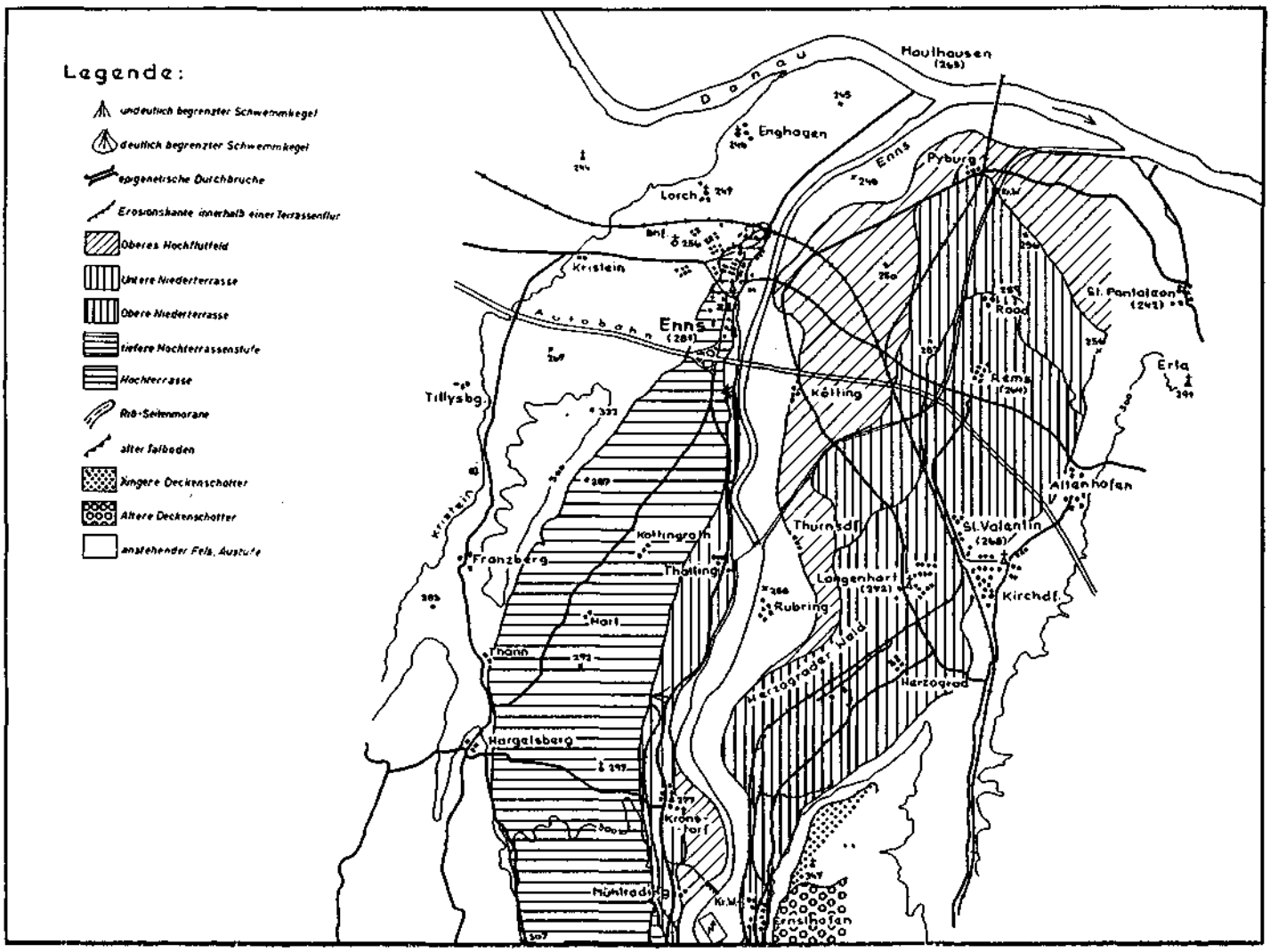

Fig. 3.1.2.: Quarternary geological map of the lower Enns valley (VAN HUSEN, 1971)

KM 164,0: Conglomerates:
The conglomerates belong to the "Ältere Deckenschotter" deposited upon "Schlier".

EXIT: "ANSFELDEN":
In Ansfelden, a town south of Linz, the composer Anton Bruckner was born in in 1824 and died in 1896 in Vienna.

KM 183,0: View to the front: Traunstein (1691 m):
Here we see the Traunstein (1691 m) for the first time. It is built of Mid Triassic Wetterstein Limestone. The Traunstein is close to the northern border of the Northern Calcareous Alps at the east side of lake Traunsee near the town of Gmunden in Upper Austria.

KM 187,0 -189,0: Crossing the "Traun-Enns Platte":
The "Traun-Enns Platte" is named after the River Traun which is the western border and the river Enns in the east. This plain is covered with huge deposits of pleistocene gravels brought from the Alps by several rivers such as the Traun, the Alm, the Krems and the Enns. At the surface the most widespread sediments are „Ältere Deckenschotter". This is due to the great extension of the glaciers during the Günz period. Terminal moraines of later periods (Mindel, Riss, Würm) are found more in the south.
In southern parts there are also several outcrops of the „Kremsmünsterer Nagelfluh", a white breccia which was deposited in a colder period (?Haslach) within the intervall of Günz and Mindel (KOHL, 1996). This 4 to 10 m thick sediment has been a common building stone since Roman times.

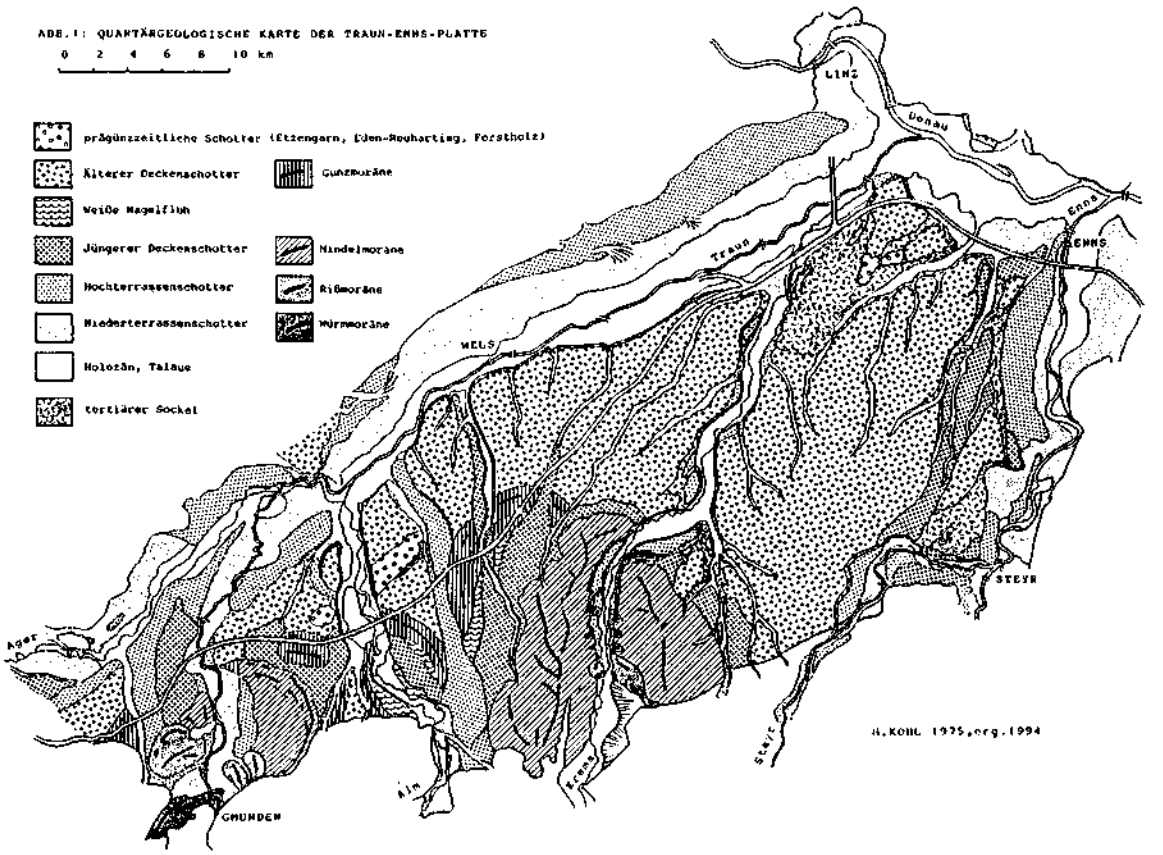

Fig. 3.1.3.: Quartemary geological map of the Traun-Enns-Platte (from KOHL, 1994)

KM 194,0: Oil-Field Sattledt:
This field produces oil from autochtonous Eocene sands and limestones from depths of 1700-1750 m covering the crystalline of the Bohemian Massif. The field belongs to the "Rohölaufsuchungs AG (= RAG)", which is operated by SHELL.

EXIT: SATTLEDT and VORCHDORF:
Here we are at the level of the Günz-Moraine. These deposits could be identified from large artifical outcrops during the building of the highway in the fifties. These deposits come from Pleistocene glaciers of the Steyr and Krems-Valley and the Alm-Valley.

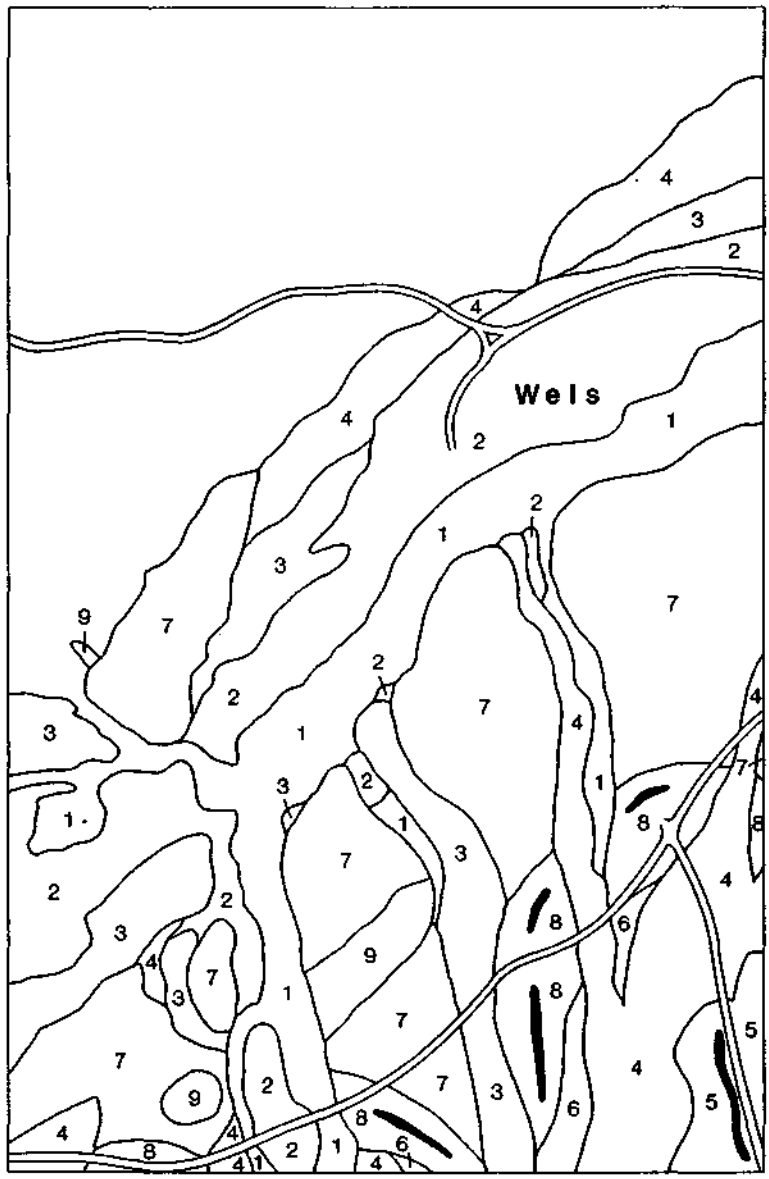

Fig. 3.1.4.: Overview of Pleistocene sediments on map sheet 49 Wels (from: KOHL et al, 1997)
1 = Holocene deposits, 2 = Gravels of the Niederterrasse (Würm), 3 = Gravels of the Hochterrasse (Riß), 4 = Jüngere Deckenschotter (mindel), 5 = Mindelmoraine, 6 = Weiße Nagelfluh (?Haslach), 7 = Ältere Deckenschotter (Günz), 8 = Günzmoraine, 9 = Gravel from Reuharting-Schnelling (oldest Pleistocene to Pregünz)

KM 202,5: Panoramic view to the south
To the east we see Totes Gebirge (2093 m, Upper Triassic Dachstein Limestone) on the horizon, then there is the depression of the lake Traunsee, the peak of Traunstein (1691 m) and then the Höllengebirge (1862 m, Middle Triassic Wetterstein Limestone) which lies between the lake Traunsee in the east and the lake Attersee in the west. All the mountains at the horizon are part of the Northern Calcareous Alps.

KM 220,0: View to the south
The mountain of Hongar (943 m) close to the highway belongs already to the Flysch Zone and is built of the Altlengbach Formation, which is dominated by sandstones of the Late Cretaceous (Maastrichtian) and early Tertiary (Paleocene) and the marly Zementmergelserie, (Upper Cretaceous Campanian) (EGGER et al., 1996).

EXIT "REGAU":
Leaving the Highway at Regau we turn south towards Gmunden. Here we cross several moraines. An outer circle is divided into two parts and attributed to the Riss, the inner circle, where the town of Gmunden is situated, to the Würm (EGGER et al., 1996).

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