Bericht 1995 über geologische Aufnahmen in den Nördlichen Kalkalpen auf Blatt 68 Kirchdorf an der Krems

KRZYSZTOF BIRKENMAJER
(Auswärtiger Mitarbeiter)

Introduction

The area covered in 1995 by the 1 : 10,000 scale geological map is delimited from the east by the Steyr River valley (Oberleonstein to Steyrdurchbruch). Its southern boundary runs along the valley of Oberer and Unterer Wienerweg. Its western boundary coincides with the Krems River valley between Unterer Wienerweg and Micheldorf/Kirchdorf (Atzelsdorf). Its northern boundary runs across the mountains between Rinnerberger Bach – Hambaum and Oberleonstein.

This map was a direct southern continuation of that prepared in 1994 for the area west of the Steyr River valley, between Steyrleithen and Oberleonstein in the east, and Rinnerberger Bach – Rinnerberg – Grabmais – Pernzell in the west (K. BIRKENMAJER: Bericht 1994 über geologische Aufnahmen in den Nördlichen Kalkalpen auf Blatt 86 Kirchdorf a.d. Krems. – Jb. Geol. B.-A., 1995).

The area dealt with was mapped in 1948–49 by F. BAUER (1953: Der Kalkalpenbau im Bereiche des Krems- und Steyrtales in Oberösterreich. – In: H. KÜPPER, Ch. EXNER & H. GRUBINGER [eds.]: Skizzen z. Antl. d. Erde, 107–130, Wien [Verl. B. Hillinek]. BAUER's map is an interpretative one, largely without Quaternary cover, to a scale of 1 : 12,500, supplemented by explanatory text.

Revision of BAUER's map

There is a poor correlation between BAUER's (1953) map and the one made by the present author. The most important differences are the following:

- In BAUER's map, most of the Mesozoic (mainly Jurassic and Lower Cretaceous) rock-units are elongated SW–NE, parallel with the Limestone Alps/Flysch Zone contact. In the present author's opinion, this "elongation" is mainly a result of dense SW–NE-trending strike-slip faults, and not of tectonic elongation of the rock-units in that direction. The strikes of the Mesozoic rocks are predominantly W–E, conformably with tectonic pattern of the post-Lower Cretaceous nappes of the Limestone Alps;
- BAUER marked a few faults directed NW–SE, or NNW–SSE. The existence of these faults has not been confirmed;
- In BAUER's map, the Triassic is represented mainly by the Hauptdolomit which delimits the area from the east, and reaches south as far as Georgenberg. However, Georgenberg is built mainly of Upper Jurassic–lowest Neocomian limestones, and subordinately of Neocomian marls and marly limestones, but not of the Triassic rocks (Hauptdolomit and Opponitzerkalk in BAUER's map) which are missing there;
- BAUER distinguished the "Oberrhätkalk" along the northwestern boundary of the Limestone Alps, at their contact with the Flysch Zone. According to the present author, these limestones are Upper Jurassic–lowest Cretaceous in age;
- The "Lias Hornsteinkalk" is marked in BAUER's map as several wide zones elongated SW–NE. In the present author's view, this is an overinterpretation: the thin cherty Upper Liassic rocks occur only as discontinuous tectonic lenses, but do not form continuous zones;
- The "Lunzersandstein" marked by BAUER at Pernsteingraben, represents a lower part of the Liassic Fleckenmergel/Fleckenkalk facies (Allgäuschichten), maybe also a part of the Rhaetian Kössenerschichten;
- The "Kössenerschichten" marked by BAUER between Pernsteingraben and Hirschwaldstein are typical Liassic Allgäuschichten;
- The distribution of Lower Cretaceous marls (Neokommergel) is much more areally restricted than it was marked in BAUER's map;
- The occurrence of "exotic pebbles", marked in BAUER's map at two places along the Limestone Alps/Flysch Zone boundary, and considered by him to represent weathered remains of the "Cenomanklippenzone" unit, has not been confirmed. In the present author's opinion (BIRKENMAJER, 1995 – see above), such exotic pebbles (if any) could be remains of Tertiary river terraces. Contrary to BAUER's view, there is no evidence for the existence of the "Randcenoman" tectonic unit, either at the Limestone Alps/Flysch Zone contact, or under the nappes of the Limestone Alps.

Main tectonic units

The map area represents the northwestern, SW–NE-running margin of the Limestone Alps at their contact with the Flysch Zone. Following BAUER (1953), two facies-tectonic zones of the Limestone Alps have been recognized: the Ternberger Zone in the northwest, and the Reichraminger Zone in the southeast and south. The contact of these zones is tectonic: the Reichraminger Zone (Nappe) is thrust over the Ternberger Zone, represented here by its upper unit (Upper Ternberg Nappe – cf. BIRKENMAJER, 1995).

The Reichraming Nappe/Ternberg Nappe contact is traceable along the Schwarzenbach valley through upper reaches of Pernsteingraben. Along this line, the Triassic rocks of the Reichraming Nappe contact directly with the Jurassic–Lower Cretaceous rock-units of the Ternberg Nappe. The rock-units of the latter nappe are often overturned there, recumbent to the north. In upper Schwarzenbach valley, the tectonic contact of these nappes is marked by thick crush breccias of the Rauchwacke type.

Rhenodanubian Flysch Zone (Nappe)

This is the outermost (lowest) tectonic unit of the area. It borders the Limestone Alps from the northwest, contacting with the Upper Ternberg Nappe (UTN) along the SW–NE-running Tertiary strike-slip fault zone. The flysch zone probably underlies the nappes of the Limestone Alps, as it reappears in the Windischgarsten tectonic window (see S. PREY: Das Flyschfenster von Windischgarsten und seine Umgebung – Eine Dokumentation über Schichtenfolgen und Tektonik. – Jb. Geol. B.-A., **135**/2, 513–577, 1992).

The tectonics of the Flysch Zone is poorly recognizable in the area mapped in 1995. The outcrops of flysch rocks, consisting of bluish, thin- to medium-bedded laminated

micaceous sandstones, locally with blue marl intercalations, are probably mainly of Upper Cretaceous age. They dip SE 50°, towards the Flysch Zone/Limestone Alps boundary.

Upper Ternberg Nappe (UTN)

This unit is well exposed along the contact with the Flysch Zone, between Rinnerberger Bach in the NE, and Georgenberg (vel Georgiberg) in the SW. It consists of three subunits: lower (UTN_1), middle (UTN_2), and upper (UTN_3). These units are superimposed one over another, usually with a normal stratigraphic sequence. No Lower Malm radiolarite horizon has been recognized in any of the three subunits of the UTN, contrary to the area north of Rinnerberger Bach (see BIRKENMAJER, 1995).

The UTN_1 subunit consists mainly of Jurassic (Liassic to Tithonian) and Lower Cretaceous rocks: cherty limestones and cherts (Upper Liassic), crinoid limestones of the Vilserkalk type (Dogger), red limestones (Lower Malm), thick massive white limestones (Tithonian–Berriasian), thin spotty cherty limestones (Lower Cretaceous), and grey-green marls (Lower Cretaceous). The Dogger–Malm limestones seem to contact tectonically directly with the Triassic (Hauptdolomit).

The UTN_2 subunit consists mainly of Jurassic and Lower Cretaceous rocks. Small outliers of the Triassic rocks, represented by the Hauptdolomit and the Dachsteinkalk, occur at the base of the unit in Hirschwaldstein, northeast of Burg Altpernstein. Spotty limestones and marls of the Allgäuschichten (Liassic), locally more silty (?Kössener Schichten, Rhaetian), and associated with grey crinoid limestone lenses (?Rhaetian) occur in a wide zone along the contact with the Reichraming Nappe. In the northeastern part of Hirschwaldstein, the tectonic base of the UTN_2 subunit is formed by crinoid limestone of the Vilserkalk type (Dogger) and red Malm limestones which are thrust directly over the Lower Cretaceous marls of the lower subunit (UTN_1).

The Upper Liassic through Lower Cretaceous sequence of the UTN_2 subunit is similar to that of the lower subunit (UTN_1). It consists of cherty limestones and cherts (Upper Liassic), crinoid limestones (Dogger), red limestones (Lower Malm), thick massive white limestones (Tithonian–?Berriasian), thin spotty cherty limestones (Lower Cretaceous) and grey-green marls (Lower Cretaceous).

At a locality south of Burg Altpernstein, a thin band of red limestone (?Liassic) occurs between two crinoid limestones (Dogger and ?Liassic, respectively).

The UTN_3 subunit occurs over a small area NE from Georgenberg. It consists of thin cherty limestones and cherts (Upper Liassic), thick crinoid limestones (Dogger), and thick massive white limestones (Tithonian–?Berriasian). Red Lower Malm limestones have not been found.

The rocks of the UTN subunits are strongly dissected and displaced by a dense set of SW–NE-trending post-Flysch (i.e. Tertiary) strike-slip faults.

RT/UTN contact

The contact of the Reichraming Nappe (RN) with the Upper Ternberg Nappe (UTN, all three subunits) is a complex one. The plunging of the UTN strata under the RN has not been stated in the field. The strata of the UTN_1–UTN_3 subunits, which generally strike W–E, or WSW–ENE, arrive discrepantly at the SW–NE-running RN/UTN contact.

Between Burg Altpernstein and Schwarzenbach, the UTN_2 rock-units are tectonically reversed. Different Triassic rock-units of the Reichraming Nappe are thrust there directly upon a southern limb of a UTN_2 synform built mainly of Allgäuschichten, with tectonic breccias (Rauchwacken) developed here and there. At a few places in the Schwarzenbach valley, tectonically reduced and brecciated Upper Jurassic limestones (UTN_2), contacting with the Triassic rocks (RN), might represent fragments of a tectonically reduced southeastern, normal limb of an antiform.

Reichraming Nappe (RN)

The Reichraming Nappe consists only of Triassic carbonates and associated siliceous rocks. In the area mapped, it forms a large Tiefengrabenbach anticline in the south, and a large Steinkogel syncline in the north.

The Tiefengrabenbach anticline is formed by the Gutenstein Limestone (more than 350 m thick) in the core, and by the Gutenstein Dolostone (300–400 m thick) on the flanks. The anticline is recumbent to NNW, its axial plane dips at a steep angle due SSE. Banded carbonate rocks which form the anticline are internally strongly folded, corrugated and displaced by minor faults.

The Steinkogel syncline is formed mainly by the Dachsteinkalk (more than 150 m thick) in the core, and the Hauptdolomit (about 300 m thick) on the flanks. In the eastern part of the area, there are several intercalations of the Dachstein-type limestone (10–20 m thick) within an upper part of the Hauptdolomit.

Small outliers of the Hauptdolomit and the Dachsteinkalk occur at the base of the UTN_2 subunit in the area of Hirschwaldstein, NE of Burg Altpernstein.

Bluish-grey cherty limestones (150–200 m thick: in the eastern part of the area), and grey-green banded cherts and limestones (5–15 m thick: in the western part of the area) represent the Reifling facies of the Reichraming Nappe. They separate the Hauptdolomit from the Gutenstein Dolostone along most of their stratigraphic contact.

The SW–NE-trending strike-slip faults (Tertiary) are well recognizable in the northern flank of the Tiefengrabenbach anticline and in the Steinkogel syncline.

Jurassic–Cretaceous sequence (UTN)

The Jurassic–Lower Cretaceous sequence of the Upper Ternberg Nappe consists predominantly of carbonate marine deposits. It starts in the UTN_2 subunit usually with a dark, spotty marl-limestone complex, 150–200 m thick (Allgäuschichten, Liassic). At Pernsteingraben, these rocks are underlain by a complex 50 m thick of dark, spotty limestones alternating with shaly siltstones (?Kössenerschichten, ?Rhaetian), associated with several grey crinoid-limestone lenses 3–5 m thick (?Rhaetian).

Dark-grey to brownish cherty limestones and cherts (Upper Liassic) 5–10 m thick occur in all three subunits of the UTN.

They are followed by grey to white, massive crinoid limestone of the Vilserkalk-type (Dogger), 20–30 m, locally up to ?50 m thick.

South of Burg Altpernstein, there seem to occur two crinoid limestones, a lower one of Liassic age (Hierlatzkalk, 8–10 m thick), and an upper one of Dogger age (Vilserkalk, more than 4 m thick). They are separated by a band of red to pink, slightly nodular limestone of ammonitico-rosso facies (?Liassic Adneterkalk, 2–6 m thick), with haematite- and manganese oxide veinlets and coating, indicating condensed deep-water sedimentation.

The Dogger crinoid limestone (Vilserkalk) is followed by red, massive and nodular limestones 5–10 m thick, of the Lower Malm ammonitico-rosso facies (Klauskalk-type). They pass upward into white massive limestones (Ti-

thonian–?Berriasian) 50–80 m thick. These limestones, pinkish near the base, cream-yellow to white higher up, are the most conspicuous carbonate rock-unit in the area mapped. They often form klippes and picturesque cliffs (e.g., at Burg Altpernstein, in Hirschwaldstein, at Georgenberg).

In the uppermost part (1–2 m thick), these limestones become light-brownish to beige in colour, passing into a thin horizon (1–5 m) of white to light-grey, slightly spotty, often siliceous, bedded limestone, sometimes with dark-grey to black chert nodules. They represent the Biancone-facies (resp. Majolica facies) widely distributed in many areas of the northern Tethys (e.g., in the Pieniny Klippen Belt, West Carpathians). The limestone becomes marly, grey to bluish or greenish in the upper part (2 m thick at Georgenberg), and is directly succeeded by grey-green shaly marls and shaly marly limestones 20–30 m thick (Lower Cretaceous). This is the youngest rock of the Jurassic–Cretaceous sequence in the UTN.

Faulting

A system of SW–NE-trending, vertical/subvertical strike-slip faults of post-Flysch (i.e. Tertiary) age, is a typical feature of the area (BIRKENMAJER, 1995). This fault system cuts the Reichraming Nappe/Upper Ternberg Nappe contact, thus clearly postdating the nappe folding. It seems that the majority of the strike-slip faults are left-lateral.

The contact of the Upper Ternberg Nappe subunits with the Flysch Zone also corresponds to a strike-slip fault zone. This contact is, unfortunately, poorly exposed due to widespread cover of weathering and solifluction clays.

Quaternary cover and karst

Three Pleistocene and three Holocene gravelly river terraces were distinguished in the Steyr River valley south of Oberleonstein. They are a direct continuation of those recognized in the area north of Oberleonstein (see BIRKENMAJER, 1995). Pleistocene river terraces are also widely distributed in the Krems River valley between Micheldorf and Kirchdorf.

Weathering and solifluction clays cover mainly easily-weathering flysch rocks between Micheldorf and Rinnerberger Bach, and Triassic carbonates in the Unterer & Oberer Wienerweg valley. At Steinkogel (about 900 m a.s.l.), they might represent an old, possibly Neogene, planation level.

Talus, talus cones and stone fields are among the most frequent types of rock debris cover, widely distributed in the Jurassic–Cretaceous areas (Hirschwaldstein to Georgenberg) and the Triassic area. This cover is usually subject to creeping and landslides.

Karst phenomena are rare in the area discussed. Karst sinks associated with mountain-crest rifting occur at Steinkogel at about 960 m a.s.l. There are also isolated karst sinks and a few small caves elsewhere.

Blatt 91 St. Johann in Tirol

Bericht 1995 über geologische Aufnahmen in der Nördlichen Grauwackenzone auf Blatt 91 St. Johann in Tirol

HELMUT HEINISCH
(Auswärtiger Mitarbeiter)

Stand der Arbeiten

Im Zuge der Aufnahme des südlich anschließenden Blattes Kitzbühel wurden auf Blatt St. Johann gelegene Bereiche aus technischen Gründen mit erfaßt. Es handelt sich hierbei um die Nordabdachung des Kitzbüheler Hornes. Der in diesem Jahr aufgenommene Bereich reicht vom Almdorflift Gasthof Buchwiesen bis zum Eifersbach und erstreckt sich jeweils vom Fieberbrunner Achental bis zum südlichen Blattrand. Er hat eine Fläche von 3,5 km^2.

Feldgeologische und strukturgeologische Beobachtungen

Geologisch wird das Paläozoikum der Nördlichen Grauwackenzone sowie die Grenze zum Permoskyth an der Basis der Nördlichen Kalkalpen erfaßt.

In der Nördlichen Grauwackenzone dominieren Gesteinsassoziationen des basischen Magmatismus, diese sind lagig in Wildschönauer Schiefer in distaler Fazies (Löhnersbach-Formation) eingeschaltet. Bei den Metabasiten sind fast ausschließlich vulkanosedimentäre Sequenzen (Tuffe, Tuffite) vertreten. Die Abfolgen streichen Ost–West und sind in sich in kleinräumige Sattel- und Muldenstrukturen gefaltet. Die Faltenachsen liegen im Mittelwert horizontal.

Das nördlich anschließende Permoskyth besteht aus roten, grobkörnigen, dickbankigen Sandsteinen mit lokalen Einschaltungen von feinkörnigen Brekzienlagen und Siltsteinlagen. Eine Basisbrekzie im engeren Sinne ist hier nicht erhalten. Stratigraphisch sind die Gesteine der Gröden-Formation (Oberrotliegend) zuzuordnen (STINGL, 1993). Das Streichen der Abfolgen verläuft parallel zum Lagenbau in der Grauwackenzone, die Schichtung fällt mittelsteil nach Süden unter die Grauwackenzone ein. Dies koinzidiert mit dem Verlauf der tektonischen Grenze zwischen beiden Einheiten. Auch in diesem Abschnitt ist die Grauwackenzone N-vergent auf das Permoskyth überschoben. Im Wendelbach versetzten spätere N-S-Brüche die Grenze um mehrere 100 m nach Süden.

Eine Anchi-Metamorphose alpidischen Alters betraf sowohl Gesteine der Nördlichen Grauwackenzone als auch der Gröden-Formation. In den Rotsedimenten führt das gelegentlich zu Bleichungen.

Quartär

Die Talaue der Fieberbrunner Ache wird durch eine morphologischen Stufe von 10-20 m Höhe von Grundmoränenlandschaft abgegrenzt. In Anrissen zeigt sich gut erhaltene, überkonsolidierte Fernmoräne. Diese kann Mächtigkeiten von mehreren Zehnermetern erreichen. Damit ist nur in größeren Bachgräben Festgestein anzutreffen.

❄ ❄ ❄ ❄ ❄