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Geological Frame and Position of the Early Miocene Lignite Opencast Mine Oberdorf (N Voitsberg, Styria, Austria)

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Styria
Pannonian Basin
Styrian Basin
Miocene
Lignite
Stratigraphy

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Geologischer Rahmen und Position des untermiozänen Braunkohlentagebaues Oberdorf (N Voitsberg, Steiermark, Österreich)

Zusammenfassung

Diese Arbeit gibt einen geologischen Überblick über die braunkohlenführenden Sedimente der Bucht von Köflach-Voitsberg, einem Teilbecken des Steirischen Neogen-Beckens. Eine kurze Einführung über Beckenuntergrund, Sedimentfüllung und Paläogeographie des Steirischen Beckens ist miteingeschlossen.

Abstract

This paper provides a short geological introduction to the lignite deposits of the Köflach-Voitsberg Embayment which is a part of the Styrian Neogene Basin. An introduction to the surrounding rocks, bedrocks, sedimentary filling and palaeogeography of the Styrian Basin is included.

The Neogene Styrian Basin is the northwesternmost subbasin of the Pannonian Basin System (ROYDEN & HORVATH, 1988) which is surrounded by the Alpine fold belts (Eastern Alps, Carpathians, Dinarides, Text-Fig. 1; DECKER & PERESSON, 1996; NEUBAUER at al., 1995). Paleogeographically the basin deposits belong to the Central Paratethys area and bioprovince (STEININGER et al., 1985; STEININGER & RÖGL, 1984).

The Middle Styrian Swell divides the Styrian Basin into a Western Styrian Basin (WSB) and an Eastern Styrian Basin (ESB). The South Burgenland Swell separates the Styrian Basin from the Pannonian Basin (Fig. 1).

The Western Styrian Basin is divided into several subbasins, although they are not as accentuated as in the East Styrian Basin. The southernmost basin of the WSB is the Eibiswald Embayment, which is followed to the north by the Florian Embayment and, at the northern end, by the Stallhofen Embayment. The Köflach-Voitsberg Embayment is a marginal embayment of the Stallhofen Embayment, as well as the small Basin of Rein (Text-Fig. 1). The basin filling extends from the Early Miocene (Ottnangian) into the Middle Miocene (Badenian) (PAPP et al., 1978; RÖGL, 1996). Sediments of Sarmatian age were preserved only in marginal areas situated in the east (Text-Fig. 1).

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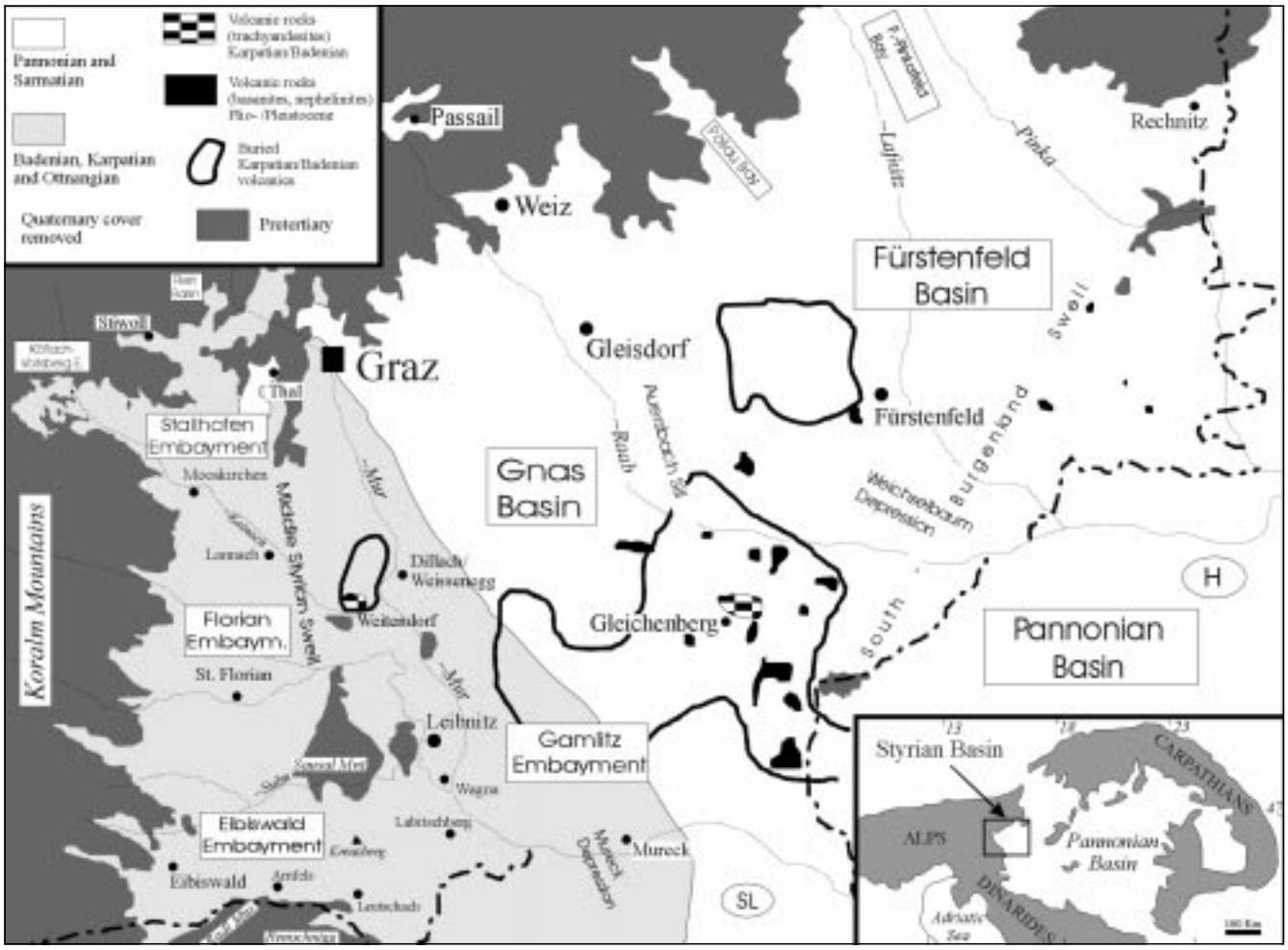


Text-Fig. 1.
Sketch map of the Styrian Basin and its position in the Pannonian Basin System.

The WSB is bordered in the east by Paleozoic rocks striking from the Plabutsch – Buchkogel area W of Graz to the Sausal swell in the south. W of this horst like structure the basement and the western border of the WSB is formed by mostly medium grade metamorphics of the Austro-Alpine Koriden Complex. In the north the Stallhofen Embayment is bordered and underlain by the Graz Paleozoic and Upper Cretaceous sediments of the Kainach Basin (FLÜGEL, 1988). The only exception is the SW part of the Köflach-Voitsberg Embayment where the metamorphic units are also outcropping.

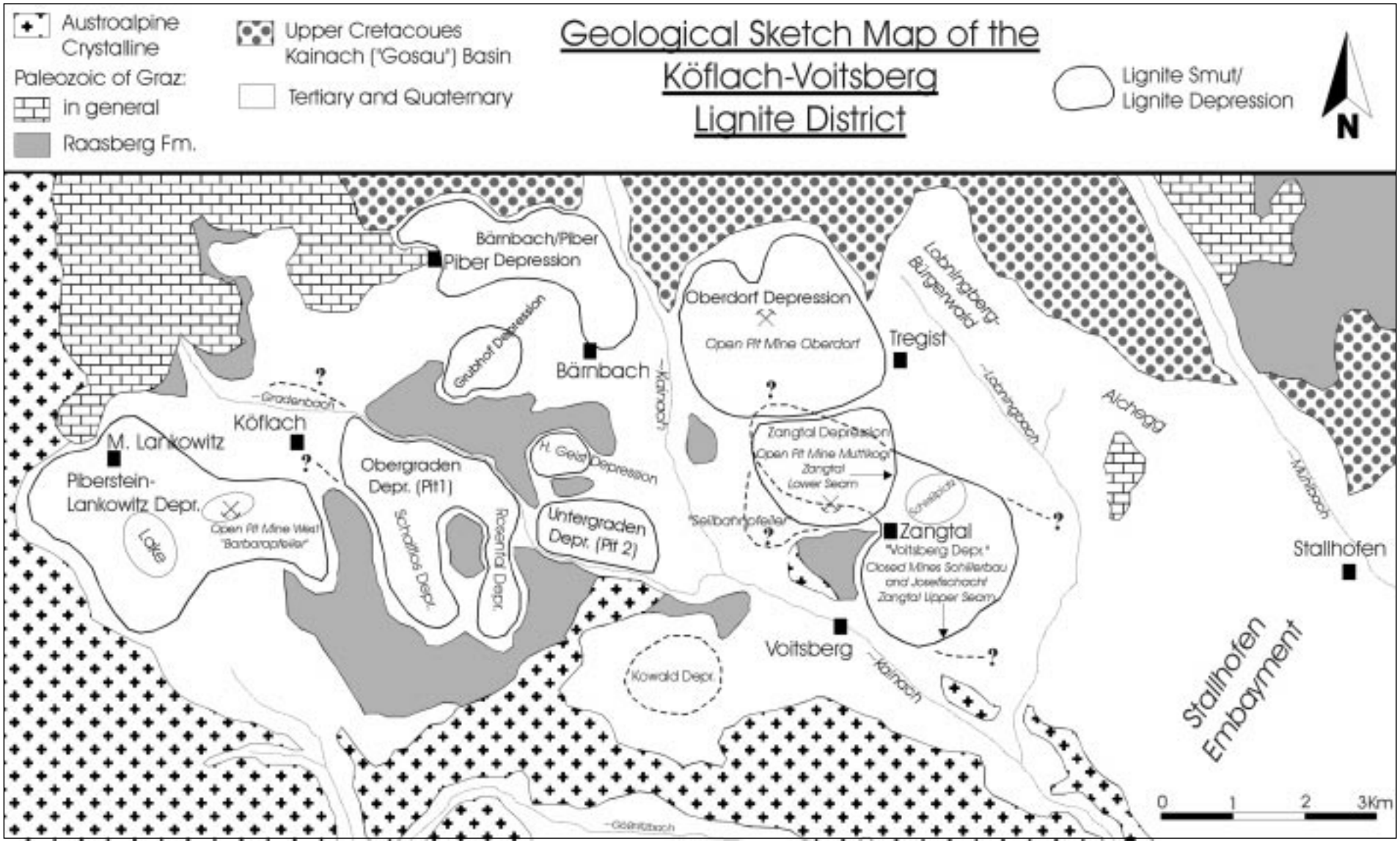
The tectonic position of the Paleozoic above the crystalline is of eo-Alpine age as well as the internal nappe structure of the Graz Paleozoic which is sealed by Upper Cretaceous sediments of the Kainach (Gosau) Basin. At the beginning of the Upper Cretaceous the crystalline was buried to deeper crustal niveaus. Its uplift is caused by extensional tectonics, the formation of the Kainach (Gosau) Basin and strike slip movements in a sinistral shear corridor along the border of the Graz Paleozoic to the uplifting Gleinalm Dome (NEUBAUER et al., 1995).

The lithofacies of the Kainach Gosau (late Santonian–Maastrichtian) represents an evolution from a coarse alluvial facies, through a lacustrine shallow water fan delta to a marine slope-type fan delta system with interfed turbiditic basin sedimentation (SCHIRNIK, 1994). Metamorphic pebbles are entirely missing in the coarse alluvial fan in which pebbles from the Graz Paleozoic, North and Southalpine Mesozoics, and marine Permian source areas can be distinguished (GRÄF, 1975; GOLLNER et al., 1987).

The Graz Paleozoic in the surroundings of the Köflach-Voitsberg Embayment is formed by low grade Devonian carbonates (Schöckel Limestone, Raasberg Formation) of the Schöckel nappe and the very low grade Rannach Nappe in a higher structural level. Westernmost outcrops of the Rannach Nappe are NW Piber and in the horst like structure of Aichegg with a Lower Devonian to Namurian carbonatic sequence (EBNER, 1985; Fig. 2). Further Devonian limestone pebbles of the Rannach Group were found at Lobmingberg in the Stallhofen Formation below the Lobmingberg Member (see below, EBNER, 1986).

In the area E of Oberdorf a prominent spur of turbiditic Upper Cretaceous sediments is dividing the E- and W-basin of the open cast mine. Of interest there were also huge boulders of Upper Cretaceous sandstones with orbitoid foraminifera and other shallow water fossils (gastropods, corals, algae) found in basal parts of the Eckwirt Member SE of Oberdorf representing materials from an Upper Cretaceous environment which is not known from outcrops today (EBNER, 1986).

The sedimentary filling of the Stallhofen Embayment begins with fluvial to limnic fine clastics (clays to sands). In more marginal areas different types of alluvial coarse clastics with some pedogenic red clay horizons are developed. These sediments are termed “Coarse” and “Fine Basis” Members of the Stallhofen Formation. The Stallhofen-Formation itself consists mainly of alluvial plain deposits (silts and clays with soil horizons). The intercalated fluvial deposits (sands and gravels, mainly braided river channels) are summarised as Eckwirt Member of the



Text-Fig. 2.
Geological sketch map of the Köflach-Voitsberg Embayment (lignite district) and its separation into various lignite depressions.

Stallhofen Formation. Another intercalation of the basal Stallhofen Formation is the pyroclastic Lobmingberg Member (EBNER et al., this volume). It is composed of air transported tuffs, tuffitic-marly layers and/or bentonites.

Significantly the sediments of the Köflach-Voitsberg Formation include the mined lignite deposits (WEBER & WEISS, 1983; POHL, 1976). The Köflach-Voitsberg Formation is overlain by the "Basal" Members of the Stallhofen Formation. The boundary to the Stallhofen Formation is visible only in marginal positions, if coarse alluvial deposits (Eckwirt Member) are developed. The boundary is marked by erosional contacts and if present, by the Lobmingberg Member intercalation. In other areas a coarsening upwards transition is developed between the Köflach-Voitsberg Formation and the Stallhofen Formation.

The Köflach-Voitsberg Formation lignite deposits are developed in several depressions (Text-Fig. 2), one of them is the Oberdorf depression. The lignite bearing parts of the Köflach-Voitsberg Formation are termed "Lignite" Member.

Different types of basinal successions ("Basis" Member of the Köflach-Voitsberg Formation) are developed. In depressions with crystalline basement (e.g.: Piberstein-Lankowitz depression, Kowald depression) the basin filling begins with alluvial fan deposits, the other depressions having the Raasberg Formation as basement start with mainly limnic deposits.

The "Lignite" Member is developed in slightly differing ways. In the Kowald depression it contains only small sheds; the lignite seams of the Piberstein-Lankowitz depression are intercalated with fluvial deposits (sandy channels and overbanks), the other depressions contain significant limnic (partly clay-silt lake rhythmits) and fluvial deposits together with the lignites. Considerable hanging wall deposits with only minor sheds are preserved only in the Oberdorf depression.

Lithostratigraphic correlation of lignite seams between the depressions is nearly impossible. For example in the Piberstein-Lankowitz depression three main seams are developed, on the other hand in the Piber depression several thicker seams are followed by a main seam preserved only in erosional remnants, in the Graden depression one main seam is followed by a minor seam in erosional remnants, and the Oberdorf depression contains only one main seam. Generally the seams are thick in marginal positions and split into several seams in the central areas of the depressions indicating syntectonic fill of the depressions.

The main seam of the Oberdorf depression hosts the last active mining area of the district in a large open pit mine (Text-Fig. 2).

The lignite depressions of Köflach-Voitsberg are most remarkable in their regional framework, remarkable in two directions: First, the deposits are the response of the initial tectonic subsidence during the formation of the Pannonian Basin area and second, paleogeographically the Stallhofen Formation is intersecting with coastal and shallow marine Badenian sediments of the St. Florian Embayment (KOPETZKY, 1957; KOLLMANN, 1965). This transition into marine deposits connects the Stallhofen Embayment with the marine environments of the Central Paratethys.

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