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The Early Miocene Lignite Deposit of Oberdorf N Voitsberg (Styria, Austria) | Editor: F.F. Steininger

Basin Configuration of the Early Miocene Lignite Opencast Mine Oberdorf (N Voitsberg, Styria, Austria)

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Styrian Basin
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Zusammenfassung

Basierend auf den Ergebnissen geophysikalischer Messungen und von Bohrdaten wurde die Struktur und Lithologie des Beckenuntergrundes der Braunkohlemulde von Oberdorf ermittelt. Die Mulde scheint demnach aus zwei Teilmulden zu bestehen. Der achsiale Bereich der nördlichen Teilmulde, deren Basis auf etwa +320 m Seehöhe zu liegen kommt, streicht N–S. Im südlichen Bereich erfolgt ein abruptes Umbiegen der Muldenachse nach Westen bei gleichzeitiger Vertiefung (+310 m Seehöhe). Neben einem generell NE-streichenden Karbonataufbruch wird der Beckenuntergrund hauptsächlich durch die Gosau gebildet.

Abstract

Seismic and geoelectric measurements in combination with well data brought a new insight into the geometrical structure and the rock facies distribution of the pre-Tertiary basement of the Miocene open cast mine of Oberdorf (Styria, Austria). The axis of the syncline strikes N–S with a sharp turn into the western direction in the south, accompanied with a slight deepening. The base of the syncline lies in the north at a sealevel of about +320 m and in the south below +310 m. The base of the syncline seems to be built by an uplift of carbonates and by a strip of crystalline in the SE, surrounded by the Gosau in the W, N and E.

1. Introduction

In 1995 and 1996 the Institute of Applied Geophysics of the University of Leoben recorded geoelectric and seismic (refraction and reflection) data in the area of the Miocene opencast mine of Oberdorf (Styria, Austria) mainly to outline the geometry and the rock facies of the pre-Tertiary basement.

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2. Geophysical Measurements

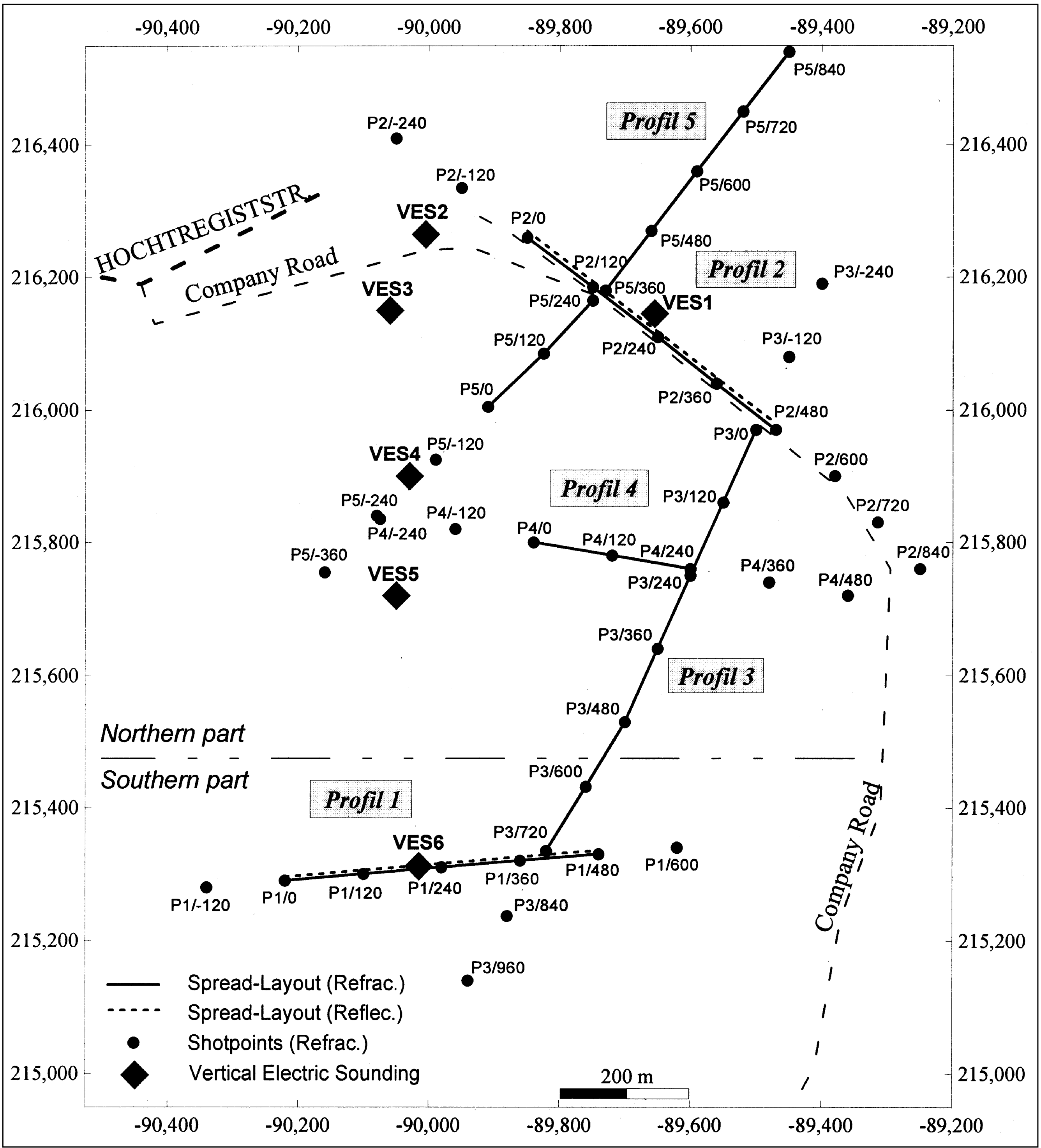
Seismic Refraction

The location of the seismic refraction survey within the opencast mine is represented in Text-Fig. 1. In summary 13 spreads have been recorded, each with a length of 240 meters (shot interval: 120 meters, geophone spacing: 10 meters, geophones: 10 Hz, charge size: 0,07 to 0,72 kg, number of channels: 24). The data were evaluated with the "generalized reciprocal method" (PALMER, 1980).

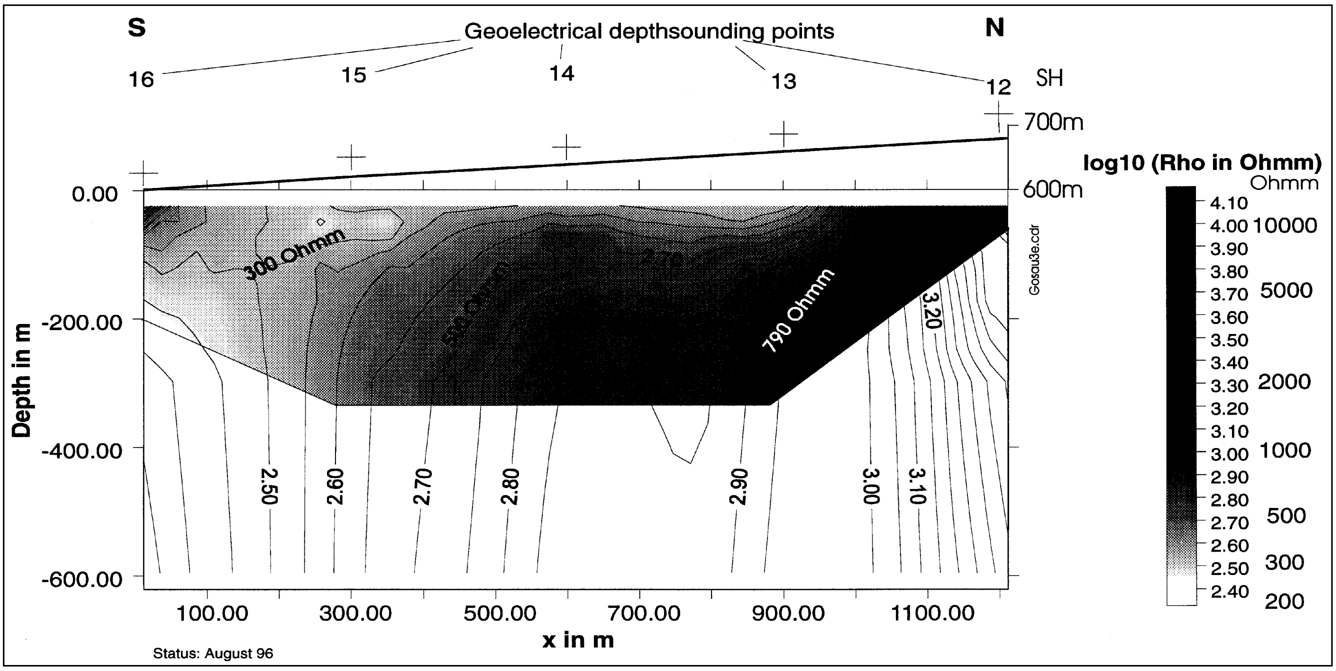
In an overall view the seismic refractions show four major horizons. The v_0 - (250 m/s–700 m/s) and the v_1 -horizon (900 m/s–1800 m/s) include the upper poor consolidated sediments, the v_2-horizon (1600 m/s–2500 m/s) corresponds to the Tertiary layers and the v_3-horizon (2800 m/s bis 4200 m/s) to the pre-Tertiary basement. In some parts the thickness of the Tertiary sediments is more than 100 meters (for detailed results see WEBER [1996, 1998]).

Vertical Electric Sounding (VES)

To investigate the possibilities to differentiate the main lithologic structure of the basement and the filling of the Oberdorf basin 6 geoelectrical depth soundings were



Text-Fig. 1.
Location map of seismic and geoelectric profiles (Gauß-Krüger Projection [M 34]).



Text-Fig. 2.
Tregistvalley – Resistivity – Depth profile.

spread within the basin extending the electrodes to the maximum possible spacings (Text-Fig. 1). The field data were collected in the year 1995 using a Schlumberger configuration and spacings of AB/2 up to 460 m. The type of the field instrument used was STING R1 from Advanced Geosciences Inc.

In most of the depth sounding curves the apparent resistivities measured are increasing rapidly at distances AB/2 of more than 200 m showing a high resistive basement at these locations [WEBER, 1996]. From these few soundings it could be seen, that resistivity information from the basement could be obtained from the geoelectric soundings making it possible to lithologically differentiate the basement with geoelectric measurements. From the collected resistivity data it seems also, that the Gosau itself is lithologically structured. High resistivities (more than 1000 Ohmm) can be interpreted as dense sandstones, conglomerates or limestones. More geoelectric data, preferably with the new multielectrode technique are needed to geoelectrically determine the lithology of the basement.

The differences in resistivity of the sediments within the basin are not very large. The coal seam has resistivities between 30 and 90 Ohmm depending on the amount of impurities e.g. clay and the water content and the accompanying shales range from 10 to 60 Ohmm.

The geoelectric soundings done within this area show the principal possibilities of the method but could be used here only as supplemental information to the lithologic information of the exploration wells drilled by the GKB (Graz-Köflacher Bergbau und Eisenbahn GesmbH). There are also some open questions in compiling the geoelectric and the well data showing some unexpected low resistivity areas within the basement [WEBER, 1996]. These questions could also be answered only with a denser geoelectric data set.

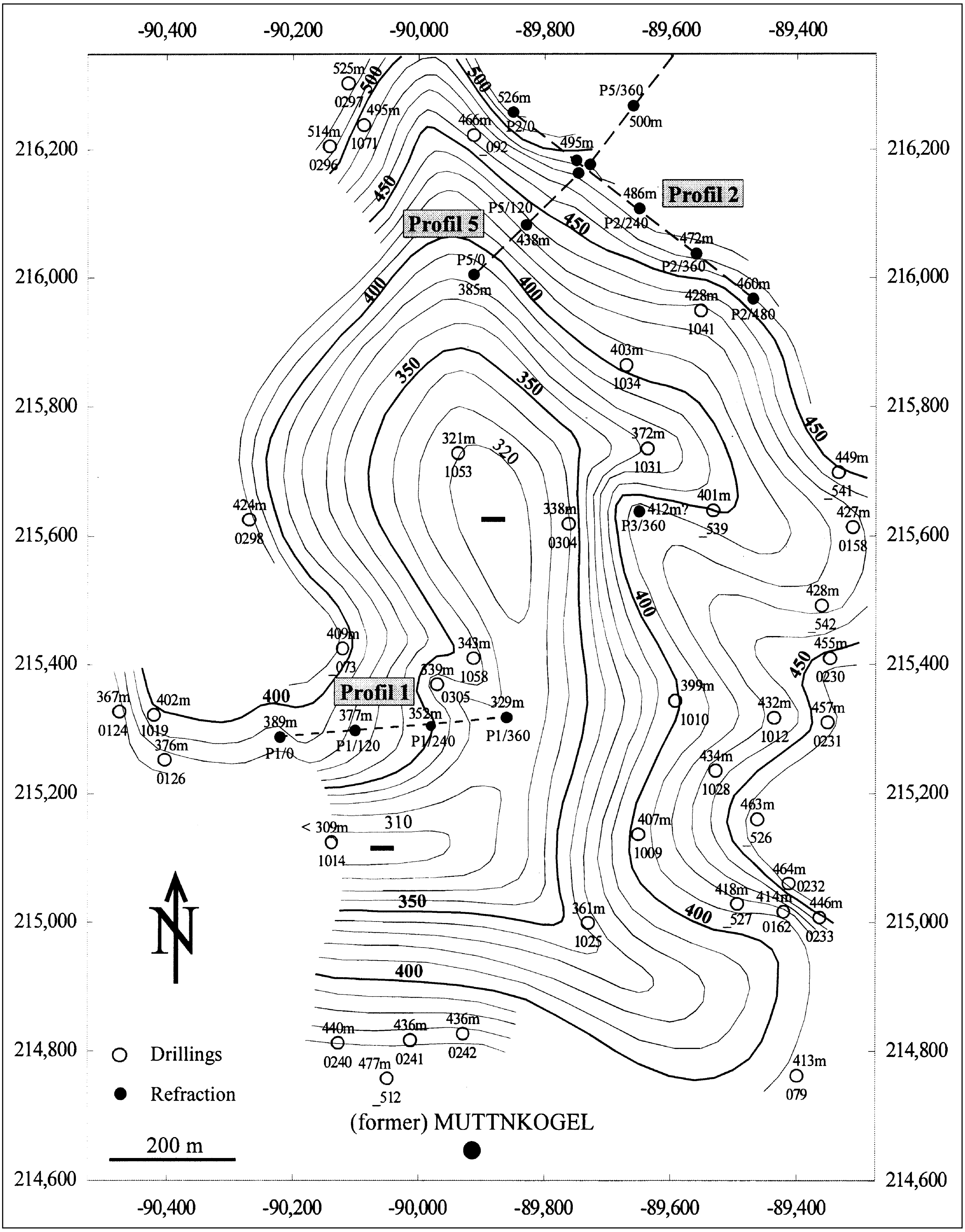
In the year 1996 additional geoelectric depth soundings were done north and northeast of the Tertiary basin of Oberdorf to investigate the resistivity differences within the pre-Tertiary Gosau basement. In this area the Gosau is near the surface with only a thin sedimentary cover. The resulting geoelectric profile is shown in Text-Fig. 2. In the southwest of the profile the average resistivities are about 350 Ohmm increasing up to 500 Ohmm to the northeast. Lithologically this horizon could be Gosau marl to marly limestone. Higher resistive rocks are underlying this horizon in a depth of more than 100 m. In the northwest of the profile a significant change in the lithology, the resistivities rise near the surface to more than 1000 Ohmm, could be seen on the resistivity profile. In this area it is assumed that the Gosau consists of limestones, conglomerates and quartzitic sandstones, showing that geoelectric measurements can give more details on the layering in this area. A significant downdip to the south of the high resistivity basement is detected. Also the intragosauic isoohms show the same dip (Text-Fig. 2).

3. Interpretation

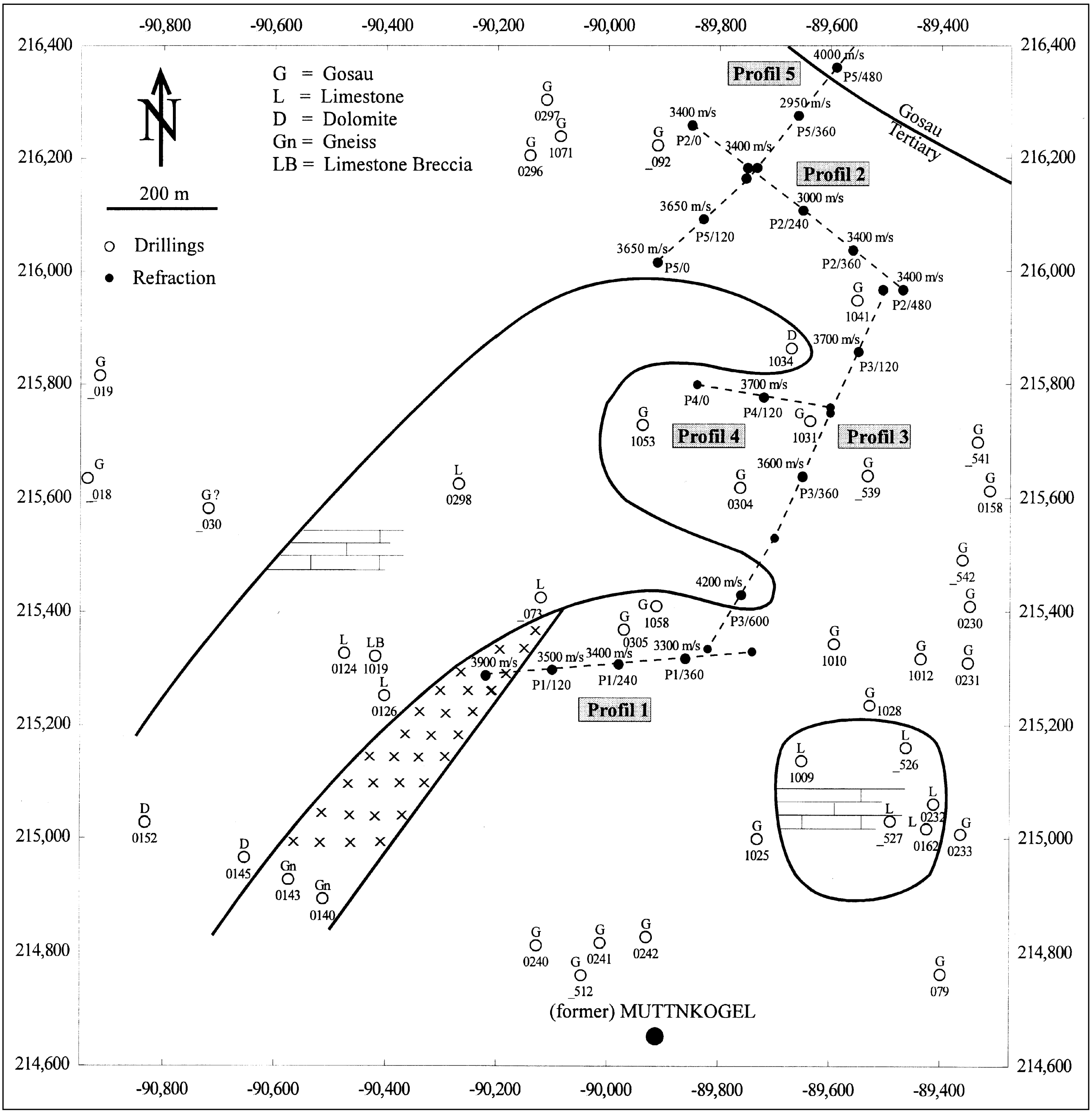
Based on the results of the geophysical data and additional drilling data of the mining company a map of the geometry (Text-Fig. 3, handdrawing) and of the lithofacies (Text-Fig. 4) of the pre-Tertiary basement was developed. These maps are initial approaches to the real basin configuration and can be helpful for solving questions concerning the basin origin, evolution and sedimentation.

The basic features are the N–S striking of the basin area in the northern part followed by a sharp break into the western direction accompanied with deepening in the southern part. The southern part of the basin shows also a gentle phase out into southeastern direction. Additionally a spur reaches from the east into the main basin area. In the north the deepest part of the basement lies at about +320 meters sealevel and in the south deeper than +310 meters. Therefore the Tertiary sediments must have covered 180 meters at the most. Linkings have been found along the v_3 -horizon (basement) but faults could not be detected unambiguously. The general increase of the seismic velocities of the Tertiary in the northern and northeastern part of the basin can be interpreted as an increase of coarser sediments.

For the lithofacies arrangement of the pre-Tertiary basement the following assumptions have been made: Palaeozoic carbonates 4000 m/s to 4200 m/s, metamorphic rocks about 4000 m/s, Gosau 2800 m/s to 4000 m/s. Beneath the Tertiary carbonates crop out in a generally SW–NE direction, flanked by a small strip of metamorphic rocks in the south and surrounded by the Gosau.



Text-Fig. 3.
Sea-level isolines [m] according to drillings and refraction seismics (Gauss-Krueger Projection [M 34]).



Text-Fig. 4.
Lithofacies map of the basement according to drillings and refraction seismics (Gauß-Krueger Projection [M 34]).

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