Abstrakt

Naftově geologickým průzkumem prováděným v období 1981—1988 v jihovýchodní části karpatské předhlubně byla prokázána plynonosnost miocenních pískovcových obzorů v oncophorových vrstvách a ve šlírovém vývoji karpatu. Bylo objeveno společné československo-rakouské naleziště zemního plynu Nový Přerov — Altprerau. Plynné uhlovodíky na tomto nalezišti jsou vázány na 1., 2., 4. oncophorový horizont a na pískovcový obzor ve šlírovém vývoji karpatu. Průzkum naleziště byl ukončen a stanoveny geologické zásoby.

V další etapě průzkumu byly objeveny další plynonosné struktury v oblasti Pottenhofenu a Neuruppersdorfu. Akumulace zemního plynu jsou vázány na svrchní část karbonátů jury (vrt Pottenhofen—2) a na pískovcové obzory oncophorových vrstev (1. — 9. oncophorový horizont). Průzkum na těchto strukturách v současné době pokračuje. Na základě těchto příznivých výsledků, získaných vrtným průzkumem v molasových sedimentech, je možno předpokládat objevení dalších analogických struktur vázaných na miocén karpatské předhlubně.

Zusammenfassung

Durch die im Zeitraum 1981—1988 durchgeführte erdölgeologische Erkundung wurde im südöstlichen Teil der Karpatenvortiefe die Gasführung der miozänen Sandsteinhorizonte in den Oncophora-Schichten und in der Schlierentwicklung des Karpats nachgewiesen. Es wurde eine gemeinsame tschechoslowakisch-österreichische Erdgaslagerstätte Nový Přerov — Altprerau entdeckt. Die gasförmigen Kohlenwasserstoffe sind an den 1., 2. und 4. Oncophora-Horizont und an den Sandsteinhorizont in der Schlierentwicklung des Karpats gebunden. Die Erkundung der Lagerstätte ist beendet und es wurden ihre geologischen Vorräte berechnet.

In der darauffolgenden Etappe der Erkundungsarbeiten wurden weitere gasführende Strukturen im Raum Pottenhofen und Neuruppersdorf entdeckt. Die Erdgasakkumulationen sind an den oberen Teil der Jurakarbonate (Bohrung Pottenhofen-2) und an die Sandsteinschichten der Oncophora-Horizonte (1. — 9. Oncophora-Horizont) gebunden. Die Erkundung der genannten Strukturen wird gegenwärtig fortgesetzt. Aufgrund dieser günstigen Ergebnisse, die durch Bohrerkundungsarbeiten in Molassesedimentgesteinen erzielt wurden, kann die Entdeckung weiterer, an das Miozän der Karpatenvortiefe gebundener analogischer Strukturen vorausgesetzt werden.

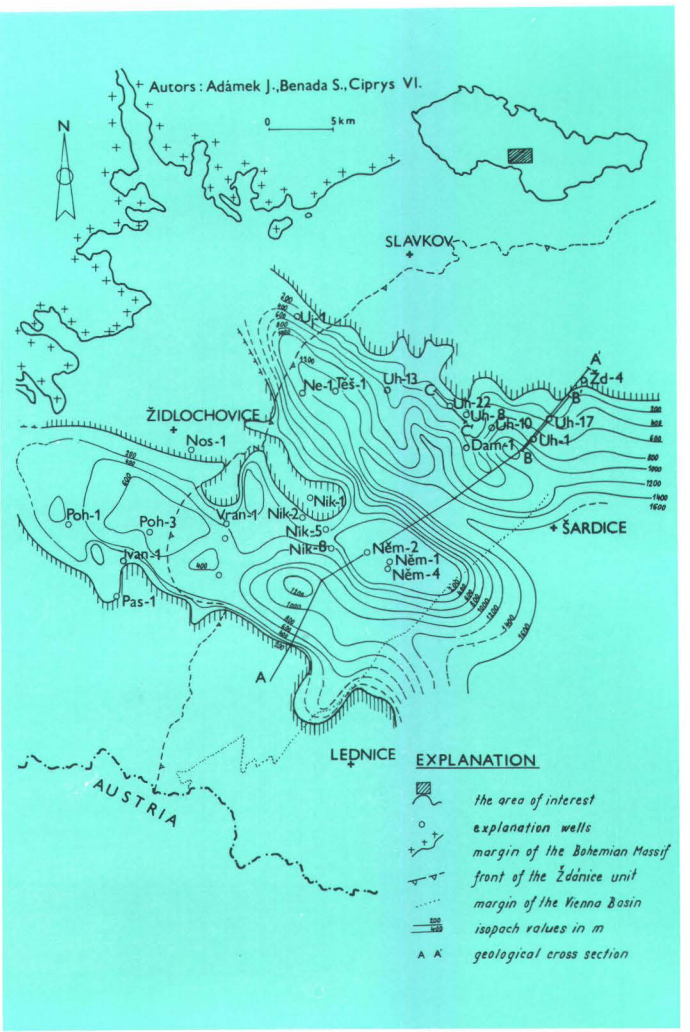

Fig. 1: Isopach map of Paleogene sediments.

NEW DATA ON THE EXTENT, STRUCTURE AND DEPOSITS OF THE AUTOCHTHONOUS PALEOGENE IN THE NESVAČILKA GRABEN

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Recently new results have been obtained when prospecting for oil and natural gas in Paleogene sediments preserved on the southeastern flanks of the Bohemian Massif. Autochthonous Paleogene sediments have widespread occurrence, above all, in two extensive depressions in the Nesvačilka and Vranovice grabens, the axes of which are perpendicular to the margins of the Bohemian Massif. In the northern part, the Paleogene sediments are covered with Neogene sediments of the Carpathian Foredeep while they are overlain by overthrust flysch nappes of considerable thickness in the southern part.

The extent of the Paleogene sediments is obvious from Fig. 1 depicting thicknesses of the autochthonous Paleogene rocks. Both the Nesvačilka and the Vranovice grabens penetrate deep into the Bohemian Massif and, locally, Paleogene sediments even extend beyond the margins of the grabens. The original extent of Paleogene sediments on the flanks of the Bohemian Massif is generally believed to have been a much broader one; however, a part of these sediments was eroded and a part removed by the flysch nappes. Paleogene sediments are included in the basal parts of the Ždánice unit, but they also form separate paraautochthonous slices.

Paleogene sediments were incountered in more than 40 deep wells; in regions not explored by exploratory drilling these sediments can be correlated by a comparatively closely-spaced network of seismic profiles. A maximum thickness of 1,000 to 1,500 m has been assumed for the axial part of the Nesvačilka graben. The interpretations base on the results of the Těšany-1, Nesvačilka-1 and Pohořelice-3 boreholes. In the southern part, the identification of Paleogene sediments in seismic materials is limited by the margin of the Vienna basin, where the quality of seismic data considerably decreases. In this area, the surface of Paleogene sediments is thought to occur at depths greater than 4,000 m and these sediments are strongly reduced by overthrust nappes.

Stratigraphy of Paleogene sediments has been studied in detail, at the present time, by the geologists of the Moravian Oil Company (MND), Hodonín, of the Central Geological Survey, Prague and of Charles University, Prague. The conception of a consecutive transgression of the sea has been generally accepted. Two somewhat differing opinions on the age of the autochthonous sediments have been presented. Jiříček (1987) places these sediments into the Upper Eocene — Lower Oligocene, whereas Hamršmíd, Krhovský, Švábenická (1988), basing on nannoplankton investigations, believe these sediments to be of Paleocene to Oligocene age. Most probably the older sediments were redeposited, in great part, during the last and most important transgression in the Upper Eocene — Lower Oligocene.

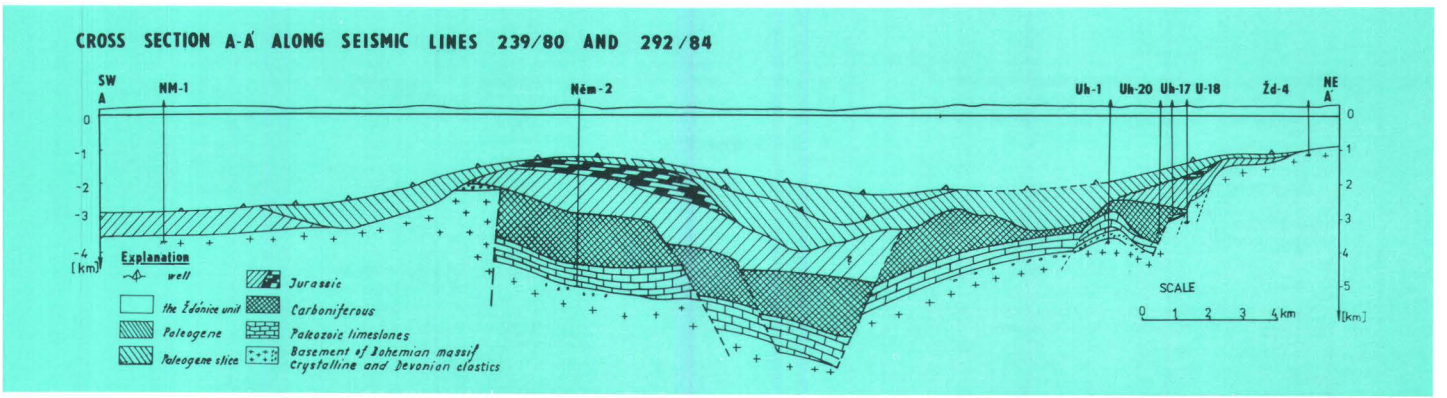


Fig. 2: Cross section A—A' along seismic lines 239/80 and 292/84.

This is documented by a great number of redeposited microfaunas present in Oligocene sediments. Upper Oligocene sediments have been known mainly from tectonic slices emplaced in the lower parts of the Ždánice nappe. Their original area of sedimentation was situated farther southeast below the present-day nappes.

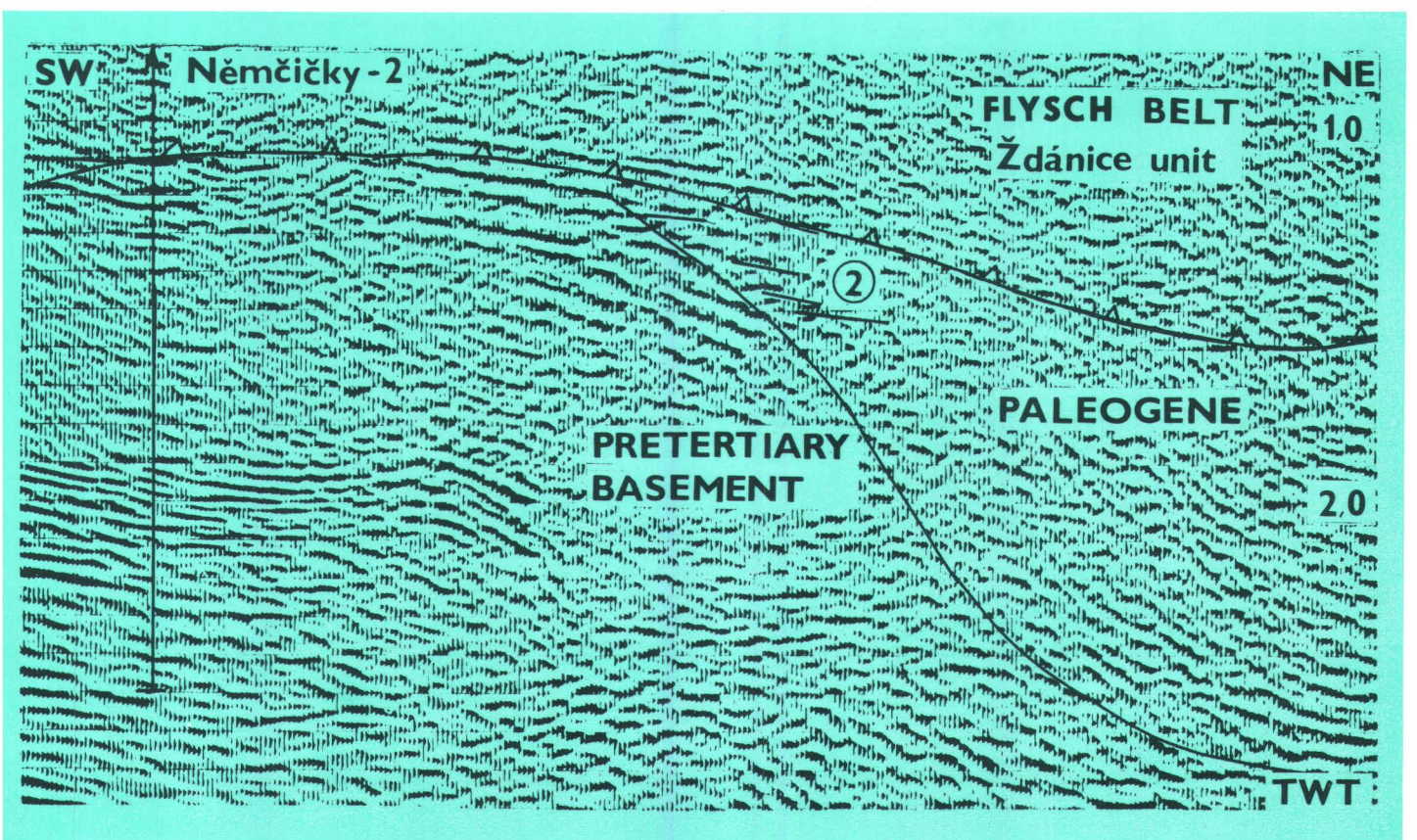
The Nesvačilka and Vranovice grabens are supposed to have been founded to old faults. Their activity was revived in dand after Jurassic time. The two young depressions filled with Paleogene sediments appear to have originated due to erosion which was the dominating element mainly during the last stage of their modelling.

Fig. 2 illustrates a geological cross-section along seismic profile 292/85 — 239/80 running SW—NE and crossing the Nové Mlýny-1, Němčičky-2, Uhřice-1, 20, 17, 18 and Ždánice-4 boreholes. It displays the principal geological features of the whole region. The basement consists of plutonic rocks of the Pavlov-Waschberg block in the south and of the central Moravian block in the north. A thick Paleozoic rock complex was deposited in the tectonically active zone between these blocks. Sediments of the clastic Devonian (Old red facies), carbonates (Devonian — Lower Carboniferous) and clastic facies of the Lower to Upper Carboniferous have been recognized in this region.

The original Paleozoic basin was rebuild and reduced after Variscan folding that had also affected the margins of the Bohemian Massif. Another transgression of the sea occurred in the region under study in Jurassic time. After the revival of tectonic activity some blocks were incised and the majority of Jurassic sediments, mainly those in the central parts of the Nesvačilka and Vranovice grabens, were eroded.

In the time section of seismic profile 239/80 (Figs 3, 4), the Paleogene interval is characterized as a prevailingly reflection-free zone. Several anomalous reflection groups can be interpreted at different time levels in some points of this interval. The reflection groups are defined as seismic facies and denoted 1, 2 and 3. Two of these facies are dominating,

Fig. 3: True amplitude seismic section 239/80 (left part) across the Nesvačilka graben showing the distribution of seismic facies in the Palaeogene. 2 — seismic facies.



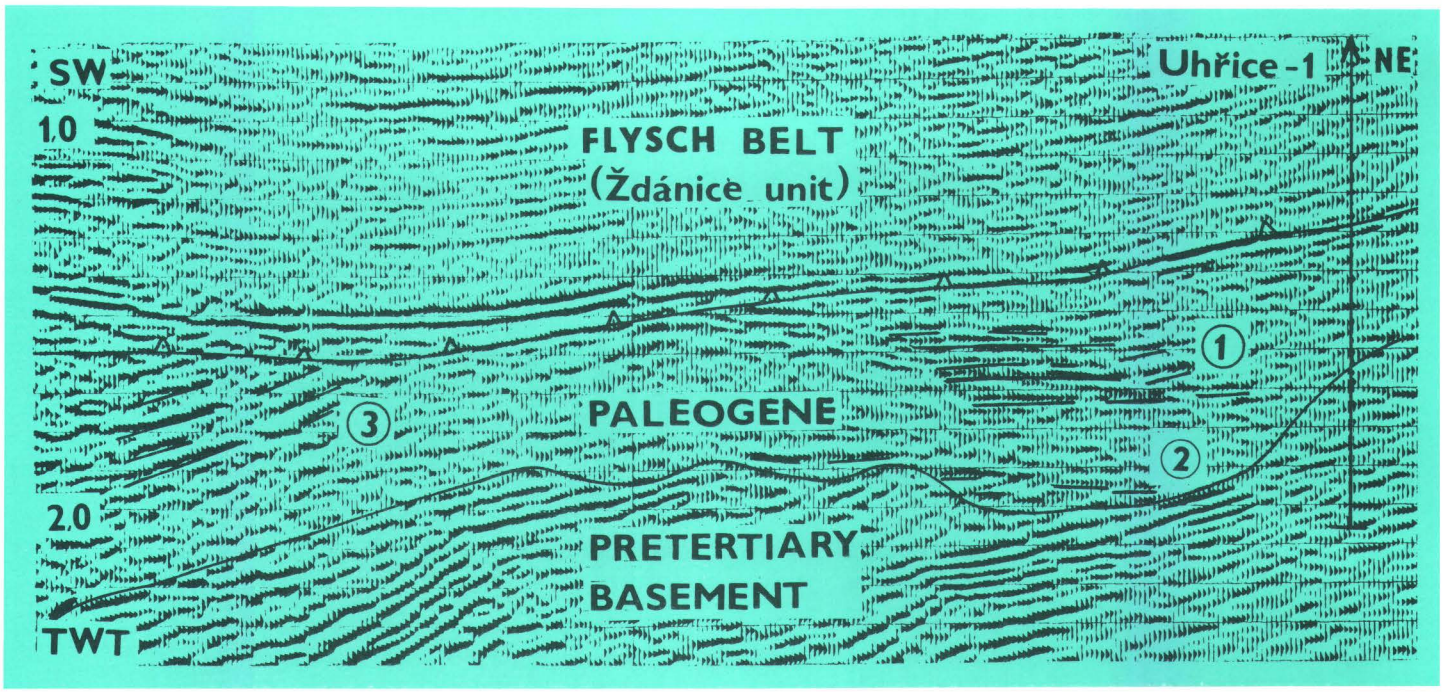
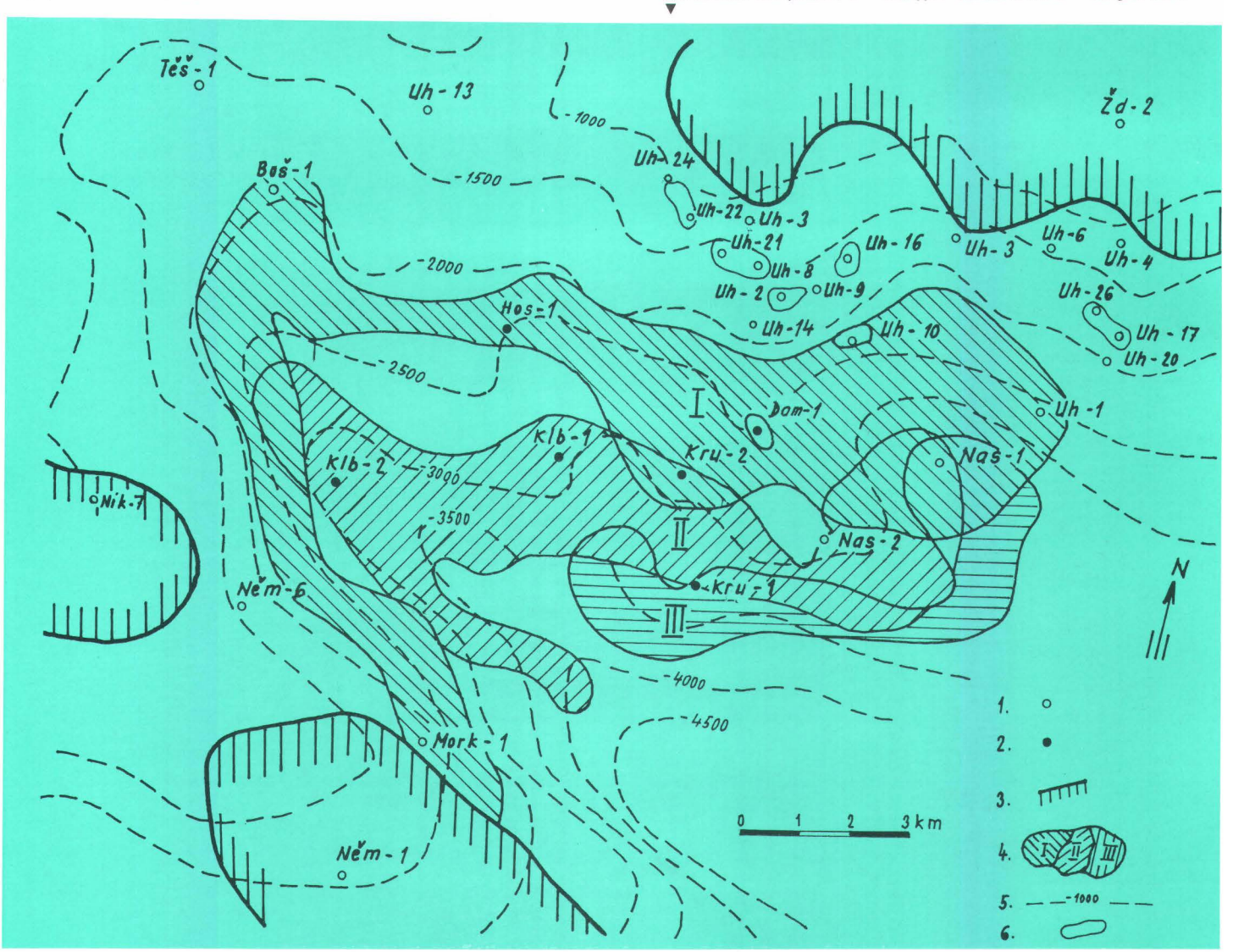


Fig. 4: True amplitude seismic section 239/80 (right part) across the Nesvačilka graben showing the distribution of seismic facies in the Palaeogene. 1, 2, 3 — seismic facies.

Fig. 8: Hypothetical distribution of clastics in the Nesvačilka graben. 1 — well; 2 — projected well; 3 — boundary of Paleogene sediments; 4 — the clastics complexes; 5 — isohypse values in m; 6 — oil-gas field.



one of them is characterized by short, low-to-medium-amplitude, subhorizontal reflections that also occur at the base of the Paleogene complex. The other facies is distinguished by steep, relatively pronounced reflections occurring within the Paleogene complex. In some places of the slope of the Nesvačilka graben, these anomalous reflections (seismic facies) can be correlated to the clastic complexes encountered in some boreholes (Dambořice-1, Těšany-1).

The classtic complexes are thought to have been deposited as sand bars and sand belts along the shore in the course of repeated marine transgressions during the Paleogene.

Most of the Paleogene sediments consist of calcareous, sandy and silty claystones. Sandstones and conglomerates commonly appear in the lower parts of the Paleogene interval. Dominant are the following types of clastic rocks:

1. Basal conglomerate with abundant crystalline, limestone and Carboniferous pebbles,
2. Coarse-grained quartz sandstone with well-rounded quartz grains, and
3. Sandstone and conglomerate alternating with claystone and limestone and dolomite blocks.

This group of clastics comprises abundant Mesozoic redeposited material.

The quartz sandstones are the most important of these three types. They are excellent reservoir rocks with a porosity of 15—25 % and permeability of 200 to 2,000 mD.

Prospecting for oil and natural gas on the northwestern slope of the Nesvačilka graben was started in the seventies, initially with regard to Paleozoic carbonates. When testing Paleozoic deposits, favourable oil and gas indications were established in Paleogene sediments, too. Fig. 5 displays the rather complex geological setting in the Uhřice-east oil deposit (discovered by Uhřice-17 borehole). Oil accumulations occur in Devonian carbonates. It is obvious that the Uhřice-20 borehole has reached a small gas-bearing sand horizon in Paleogene rocks not far from its wedging-out. A number of similar horizons have been determined on the northwestern slope of the Nesvačilka graben. Non-commercial gas reserves have also been proved in Dambořice-1 borehole.

Fig. 6 illustrates the correlation of resistivity logs in the boreholes Uhřice-25, 22, 21 and 8. The former two boreholes have reached an ol field and the latter two a gas field. Both deposits are situated in the Uhřice-west section, also on the northwestern slope of the Nesvačilka graben. Fig. 7 shows the structural positions of the boreholes in these deposits, indicating water, oil and gas saturation. The depth of the deposit ranges from 1,600 to 2,000 m; its reservoir rocks consist of coarse-grained Paleogene quartz sandstone. The thickness of the deposit varies from 60 to 110 m. Jurassic pelites in the deeper parts of the Nesvačilka graben are regarded as the oil source rocks sealed-of by overlying impervious Paleogene pelites. Hydrocarbon migration most probably took place in Miocene time during which the source rocks became submerged to great depths and affected by high temperatures and pressures.

Fig. 7 is a geological cross-section demonstrating the situation of the Paleogene deposits in the Uhřice-west area.

The commercial reserves of the oil deposit have been estimated at 230,000 tons of low-gravity paraffinic oil and at 150 million cubic m of gas in the gas deposit. the gas contains about 95 % methane, 3 % higher hydrocarbons and 2 % nitrogen combined with CO_2.

The Paleogene sediments with layers of clastics in the Nesvačilka and Vranovice grabens are considered to be highly promising with respect oil and gas exploration. Fig 8 illustrates the distribution of clastics as assumed in the Nesvačilka graben. This interpretation bases on the evaluation of seismic data and the boreholes drilled. Presently an extensive project is under way for exploring the clastic horizons that form stratigraphic traps in various places and at different depth levels of the Nesvačilka graben.

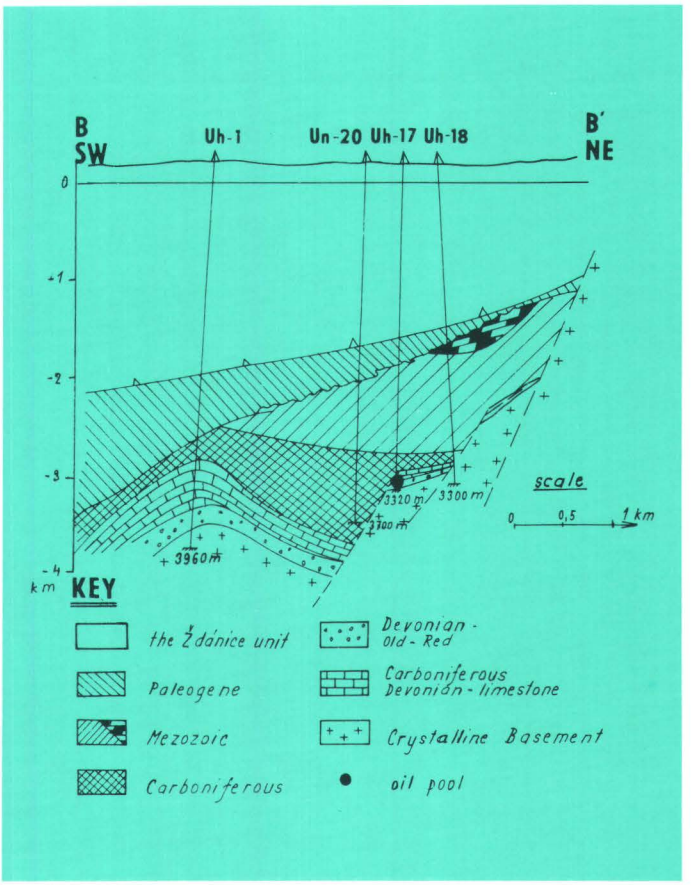
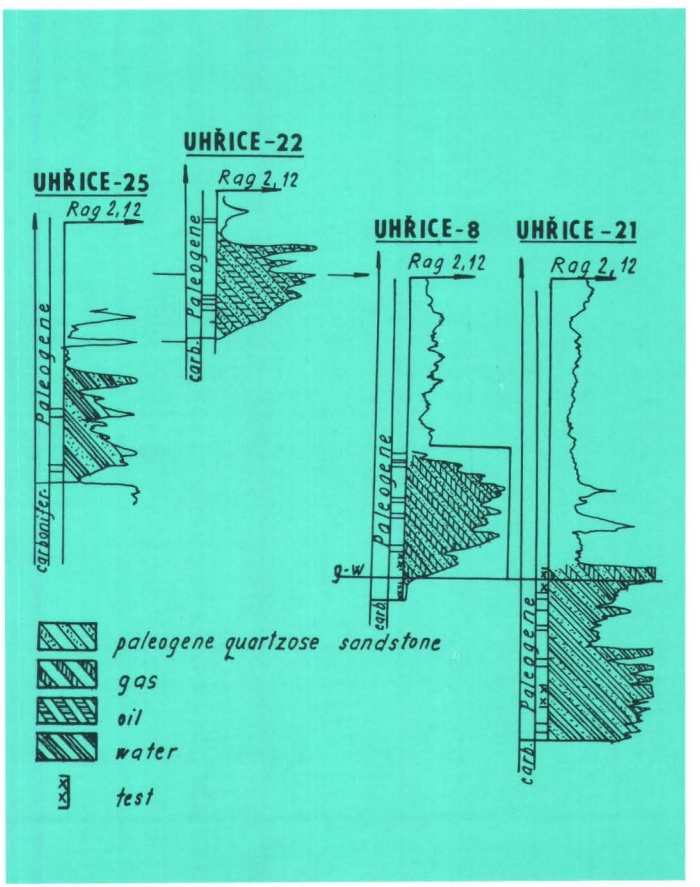


Fig. 5: Geological section BB' across Uhřice-east oil field.

Fig. 6: Comparison resistivity logs in Uhřice west fields.



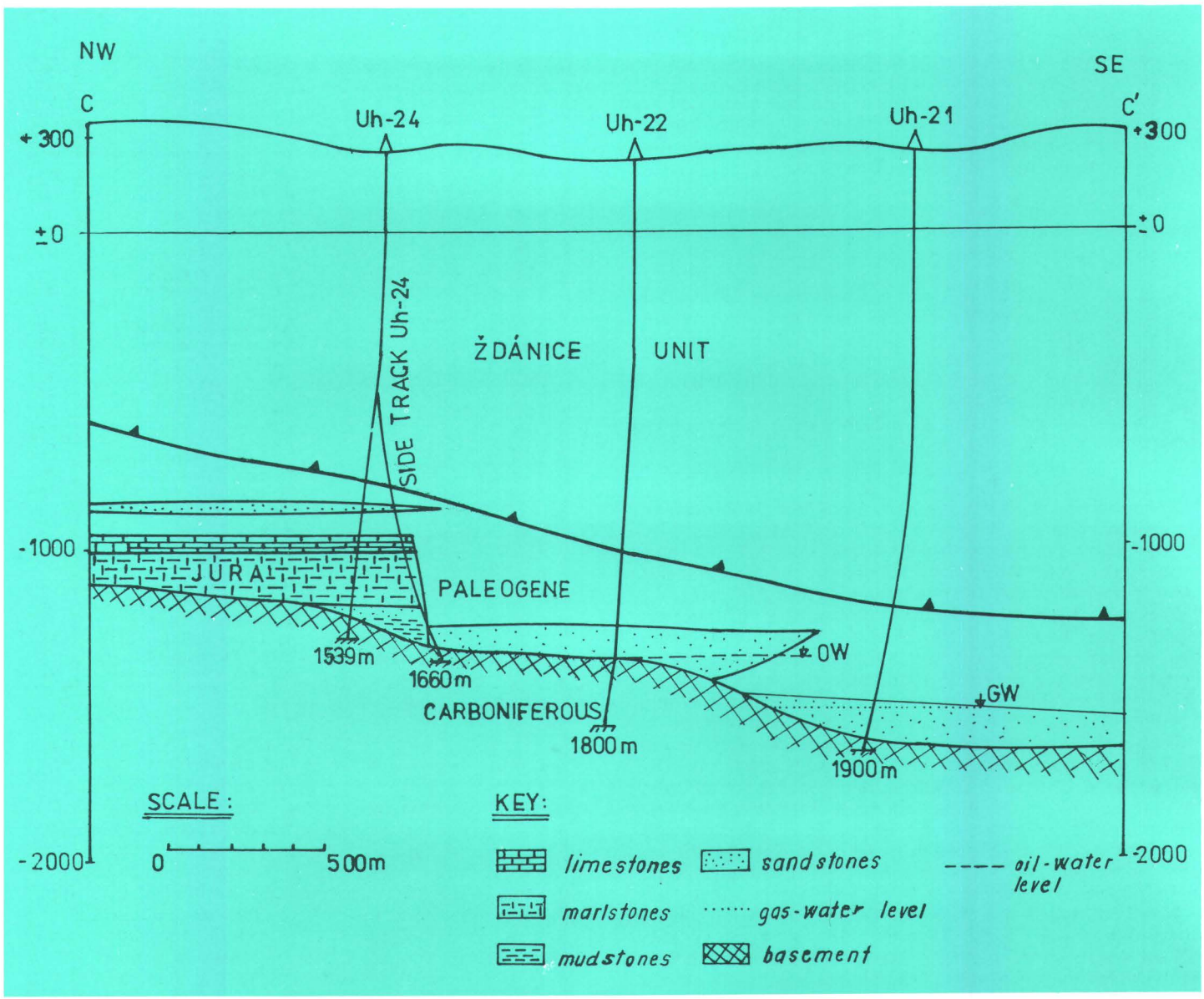


Fig. 7: Geological section C—C' across Uhřice-west oil and gas fields.

There is a good chance that, on the northwestern slope, in the central part and on the southeastern steeper slope of the Nesvačilka graben, oil and gas deposits resembling those found by the Uhřice-22, 21 8, Dambořice-1 and Uhřice-20, may be discovered.

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Abstrakt

V poslední době byly získány nové poznatky při naftovém průzkumu nesvačilského a vranovického příkopu.

Na základě více než 40 vrtů, kterými byly sedimenty paleogénu zachyceny, je sestrojena mapa mocností a geologické řezy. Stáří těchto sedimentů postupně přechází od paleocénu, eocénu do sp. oligocénu. V časových řezech seizmických profilů byly vyčleněny anomální skupiny reflexů, které jsou charakterizovány jako seizmické facie. Po srovnání s litologickými profily vrtů lze konstatovat, že ve většině případů tyto facie zobrazují vrstvy nebo komplexy klastik v jinak převážně pelitickém vývoji paleogénu. Pískovce a slepence, které se v paleogénu vyskytují, lze rozdělit do 3 základních skupin, z nichž křemenné pískovce jsou vynikajícími kolektory. Ložiska přírodních uhlovodíků byla nalezena na jz. svahu nesvačilského příkopu v oblasti Uhřice-západ. Jednotlivé plynonosné obzory byly zjištěny i na vrtech Uhřice-20 a Dambořice-1.

Zusammenfassung

In letzter Zeit wurden bei den Erdölerkundungsarbeiten im Nesvačilka- und Vranovice-Graben neue Erkenntnisse gewonnen. Aufgrund von mehr als 40 Bohrungen, welche die Sedimente des Paläogens durchbohrten, wurden eine Mächtigkeitskarte und einige geologische Profile zusammengestellt. Das Alter dieser Sedimente geht allmählich vom Paläozän und Eozän bis zum unteren Oligozän über. In seismischen Profilen wurden einige Gruppen anomaler Reflexionen unterschieden, die als „seismische Fazies" charakterisiert werden können. Nach einem Vergleich mit lithologischen Bohrprofilen kann festgestellt werden, daß diese „Fazies" meistens Schichten oder Komplexe von Trümmergesteinen in der sonst überwiegend pelitischen Entwicklung des Paläogens darstellen. Die im Paläogen vorkommenden Sandsteine und Konglomerate kann man grundsätzlich in 3 Gruppen unterteilen, von denen die Quarzsandsteine hervorragende Speicher-