V této souvislosti je třeba zvláště zdůraznit možnosti korelace údajů odporového Dcs, resp. Sonic-log, se Sigma-log.

Navíc jsou uvedené metody, umožňující včasné rozpoznání kritických situací, důležitým příspěvkem nejen k hospodárnému, nýbrž především rovněž k bezpečnému hloubení vrtů.

nen während des Bohrvorganges erwiesen.

Besonders ist in diesem Zusammenhang die Korrelationsmöglichkeit Widerstand-Dcs bzw. Sonic-Log — Sigma-Log hervorzuheben.

Darüber hinaus wird durch das frühzeitige Erkennen von kritischen Situationen ein wichtiger Beitrag nicht nur zum wirtschaftlichen, sondern vor allem auch zum sicheren Niederbringen einer Bohrung geleistet.

PROBLEMS RELATED TO THE ORIGIN OF HYDROCARBONS IN THE VIENNA BASIN

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Although questions concerning the genesis of oil and natural gas in the Vienna Basin have received much attention, the problem has again come into prominence lately, when production from deposits located in sequences underlying the Tertiary basin fill was started. Intense studies on oil genesis in the Vienna Basin have been conducted, above all, by Austrian geologists and geochemists. The investigations made by D.H. Welte, H. Kratochvil et al. (1982), H. Kratochwil, H.D. Ladwein (1984) eliminate the generation of oil hydrocarbons in the Tertiary sediments of the basin. Basing on the results of Rock-Eval pyrolysis, microphotometry and chromatographic analyses of the hydrocarbon fraction of oils and rock (bitumen) extracts, they place the "oil window" to a depth of 4 to 6 km. They regard the organic matter of Tertiary rocks as of genetic type III, and that of the underlying sequences of the autochthonous Malm and Lias-Dogger as of genetic types II to III. These authors place the oils of the basin filling, the flysch basement and the basement of the Limestone Alps into a single genetic group. Most of the oils show features of biodegradation resulting in the complete absence of alkanes. The authors relate the variable oil composition (Klement boreholes) to a terrigenous organic parent matter. In their opinion, the source rocks of the hydrocarbons of the Vienna Basin are sediments of the autochthonous Malm (downdip blocks associated with the Steinberg fault system in the southwestern part of the basin); to some extent, also coal series of the autochthonous Lias-Dogger are thought to supply some hydrocarbons, mainly gaseous ones, at depths exceeding 4 km. The geological conditions of the basin apparently favour vertical migration. Recently, the Czechoslovak authors F. Chmelík and P. Müller (1987) have advanced their views on oil genesis in the Czechoslovak part of the Vienna Basin. They investigated the thermocatalytic alteration of dispersed organic matter (kerogen) that had not been examined by previous research (V. Šimánek, 1976). In their studies, they based upon the common parameters of thermocatalytic metamorphism of kerogen (maximum pyrolysis temperature T_{max}) and the S_1, S_2 indices derived, hydrogen and oxygen indices, production index, the reflectance of vitrinoid dispersinites, etc. They based their modelling of generative hydrocarbon zoning upon the summary temperature pulse method (L. A. Polster, 1984). This approach takes account of the principles of reaction kinetics and the dependence of the conversion of kerogen to oil hydrocarbons on the time and temperature of kerogen exposure during the geological history of the basin. The model development of the zonal generation of hydrocarbons in the Hrušky-Týnec area, illustrated in Fig. 1, can be extrapolated to the whole Moravian part of the Vienna Basin with regard to the geological setting of the region. The principal zones of possible oil-hydrocarbon genesis — "oil windows" — of mesokatagenesis 1 to 3 are situated at a depth of 2.7 to 6 km in this part of the basin. In accordance with paleotemperature history, indicated by the parameters of the pyrolysis temperature maximum T_{max} and reflectance R_o (Fig. 2) the kerogen of most of the rocks investigated was found to be „immature", even at depth intervals about 4 km. The reflectance of vitrinoid dispersinites assigns about half of the rocks examined to the lower part of the oil window and the other half to the protokatagenesis zone (PK_2-PK_3), that means to the zone, where early katagenic gas and incipient oil were formed. The results can be summarized as follows: as regards the level of katagenic kerogen conversion in the Moravian part of the Vienna Basin, kerogen can be assumed to convert to oil hydrocarbons at a depth of some 3 km and deeper. Katagenic hydrocarbon generation from kerogen in the Slovak part of the Vienna Basin is demonstrated in Fig. 3. During the most rapid subsidence in Sarmatian and Badenian time, Neogene sediments along the Kúty-Leváre-Suchohrad line lowered down as deep as 5 km in the early Badenian. At this depth, they were given the temperature pulse required for the conversion of kerogen to oil hydrocarbons. In this region, thermokatagenic kerogen metamorphism corresponding to the "oil window" starts in the late Sarmatian. In accordance with the summary-temperature-pulse theory, the top of the oil window, corresponding to protokatagenesis 3 to mesokatagenesis 1 zones in the Slovak part of the basin, is localized in Badenian sediments, whereas the bottom of the oil window, corresponding to mesokatagenesis 3 to mesokatagenesis 4 zones lies at about 6 km depth in the basement of the Neogene sediments. The katagenic metamorphism of the kerogen present in Neogene sediments in this part of the basin, established at a depth of about 4 km (Závod deposit), corresponds to the oil window bottom. The results of laborataory measurements and analyses are listed in Table 1 for the Moravian and for the Slovak part of the Vienna Basin.

The results obtained by the research on thermocatalytic metamorphism of dispersed organic matter in the rocks of the Czechoslovak part of the Vienna Basin have confirmed that kerogen conversion proceeds in rocks exhibiting favourable oil-generating properties at depths of about 3 to 6 km, as indicated by the level of thermocatalytic alteration and the summary temperature pulse. In the Czechoslovak part of the Vienna Basin, favourable geochemical properties and an adequate level of thermocatalytic alteration were established for the sediments of the autochthonous Mesozoic in the Mikulov marlstone facies and the autochthonous Paleogene, and, as far as gas genesis is concerned, probably also for Paleozoic sediments. The level of thermocatalytic metamorphism does not eliminate geochemically favourably developed Tertiary sediments deposited at adequate depth from the possible generation of oil hydrocarbons in the Vienna Basin* (p. 244).

Oils of rather varying physical and chemical composition have been recovered from deposits of the Tertiary fill of the Vienna Basin: very light paraffinic oils of a specific density less than 0.870 g/cm^3 at 20 °C, light to heavy oils of paraffinic-naphthenic and/or naphthenic-paraffinic type, density 0.870 to 0.940 g/cm^3, and rather heavy naphthenic oils of a density exceeding 0.940 g/cm^3 at 20 °C. The distribution of these oil types is differentiated horizontally and in the vertical section through the basin: very light oils of the paraffinic or paraffinic-naphthenic type are associated with the (Lower, Middle, Upper) Badenian and the Paleogene of the Magura flysch; very heavy naphthenic oils are related to the Sarmatian, and light to heavy oils of mixed paraffinic-naphthenic and naphthenic-paraffinic types to the Karpatian and Eggenburgian-Ottnangian (Table 2). The individual sequences exhibit a distinct dependence of the chemical oil composition on the tectonic framework of the reservoir rocks. Deposits associated with the Steinberg fault system and the Moravian central depression contain oils

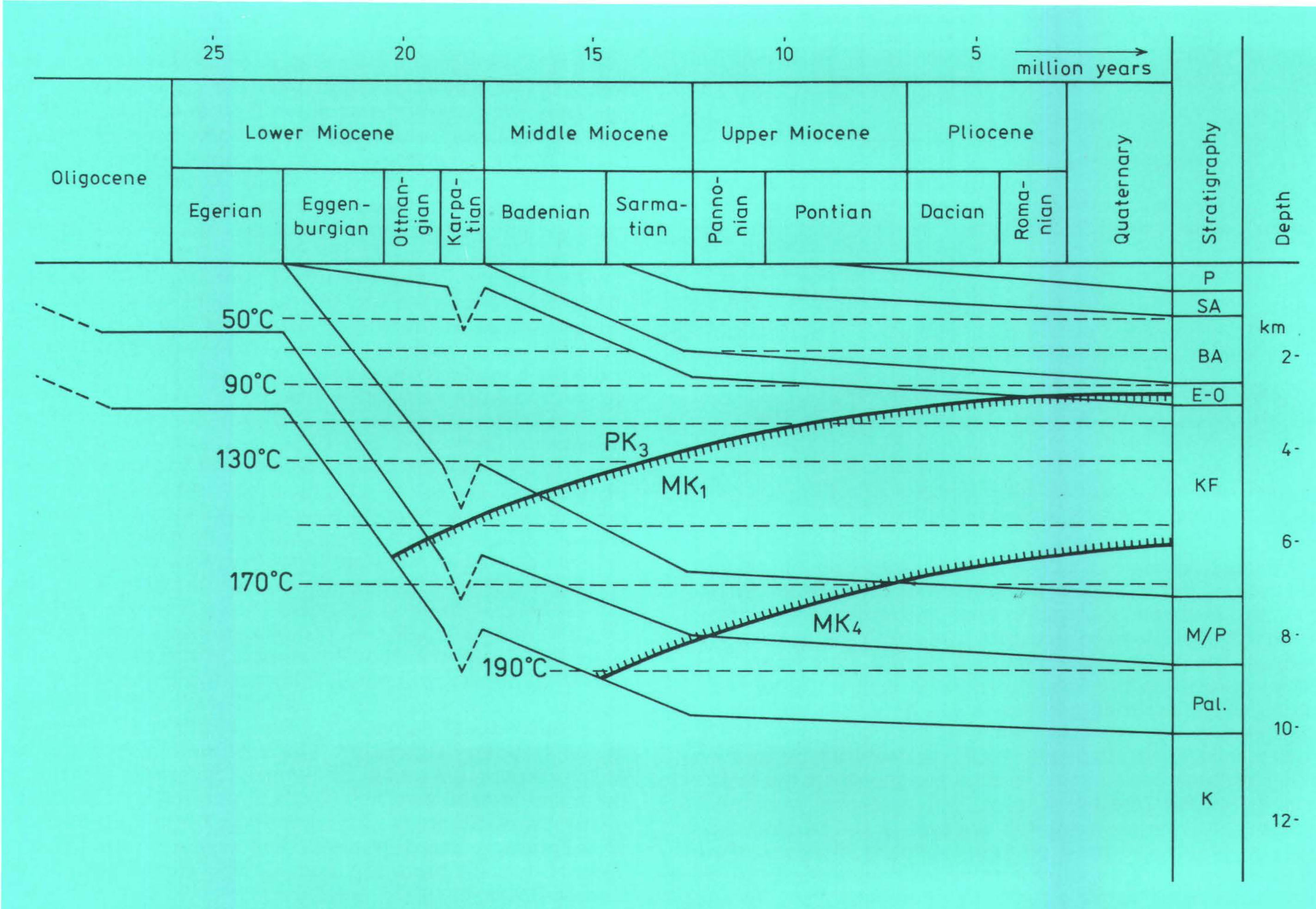
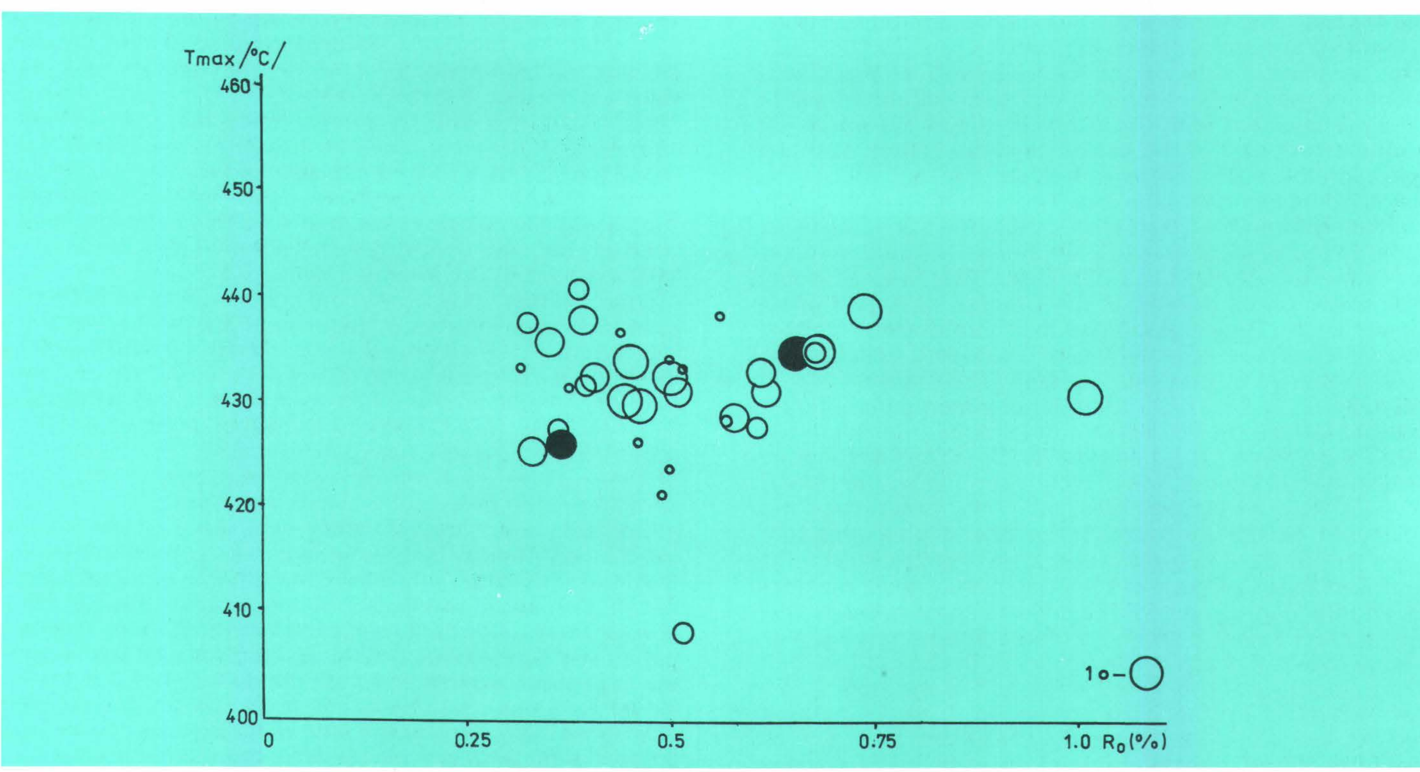


Fig. 1: Model development of the zoned origin of hydrocarbons in the Hrušky—Týnec area.

Fig. 2: Relationship T_{max}: vitrinite reflectance R_o.



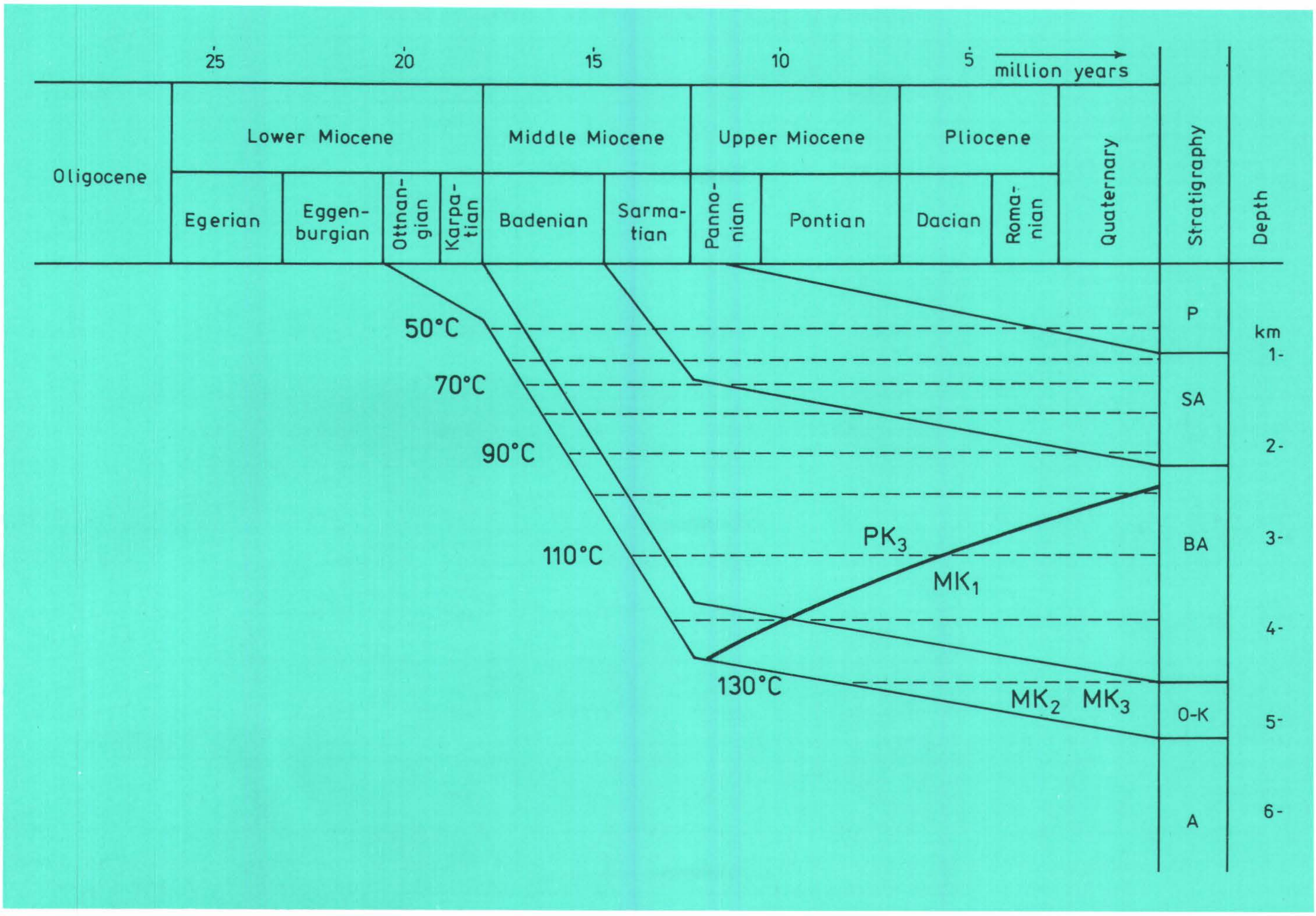


Fig. 3: Katagenic generation of hydrocarbons from kerogen in the Slovak part of the Vienna Basin.

related to the light group and exhibiting a more pronounced paraffinic character, while oils of deposits related to the Hodonín-Gbely horst or to the northern end of the Štefanov-Šaštín horst are commonly heavier, with a higher content of naphthenic hydrocarbons. The content in paraffinic hydrocarbons determined by structural type analysis varies, in reciprocal dependence on the content in naphthenic hydrocarbons. The oil composition displays a distinct tendency to a density decrease with the depth of deposition. At depth intervals from 100 to 2700 m, density decreases from about 0.950 to about 0.920 g/cm³ at 20 °C. At depths below 2 000 m distinct variations occur in the densities (Fig. 4). Particular consideration should be given to the stable physico-chemical composition of Sarmatian and Lower Badenian oils throughout the Czechoslovak part of the Vienna Basin, of Middle and Upper Badenian and Karpatian or Paleogene oils in tectonic subunits or structures, and to the rather variable physico-chemical composition of Eggenburgian and Ottnangian oils. Variations in oil composition within an identical horizon indicate the influence of the geological structure: upwards, i.e. to the structurally highest position, the oil densities decrease and the paraffinic character of the oil becomes more pronounced. Differences in oil densities at the oil/water contacts could not be determined. The concentration of n-alkanes in oils from Czechoslovak deposits ranges from several hundredths of percent by mass to several tens of percent by mass. The n-alkane concentration is consistent with the structural and chemical composition of the oils, but it is not a function of their specific and molecular mass. Saturated paraffinic hydrocarbons are missing in Sarmatian oils from 100 to 200 m depth. The oils of equivalent sequences at larger depths generally contain small to trace amounts of n-alkanes. In oils from older Neogene or Paleogene sequences, the content in n-alkanes attains more than 25 % by mass. Hydrocarbons with shorter chains — C_{14} to C_{20} — are absolutely prevailing members (see Table 3). The isoprenoid hydrocarbons of the oils in the Czechoslovak part of the Vienna Basin are generally represented by pristane and phytane which, however, do not exceed 2 % by mass. The pristane content is two to three times as high as the phytane content in the stratigraphical profile o the Tertiary sediments. The polyaromatic hydrocarbons, perylene, coronene and fluoranthene were determined. The coronene and fluoranthene contents do not exceed ppm, and perylene is bonded to oils of Neogene deposits in concentrations of some tens of ppm. In oils recovered from Paleogene, Mesozoic and/or Paleozoic sediments (Carpathian foredeep), perylene was found in trace concentrations or was absent.

Discussion

Undoubtedly genetical reasons are responsible for the differentiation in the physico-chemical composition of the oils in the Tertiary filling of the Vienna Basin. Microbial oil destruction under conditions of microbial activity certainly has played an important role, even though the stable densities of oils at the water/oil contact do not point to a substantial significance of this process: all types of oils are affected by underground aeration indicated by the absence of n-paraffines in shallower Sarmatian deposits and by "migration differentiation" dependent on migration distance.

Table 1 ORGANIC MATTER IN SEDIMENTS OF THE VIENNA BASIN

Boreholes	Depth ∅/median	% by mass C_{org}	Controlled pyrolysis				Reflecting microscopy
			IH	IO	IP	T_{max} °C	
Autochthonous Paleogene Hrušky-226, 229, Poddvorov-73	1898/1924	0,37/0,40	413/341	70/75	0,02/0,02	444/444	—
Magura flysch Břeclav-26, Lednice-8, Ježov-1	2474/3043	0,91/0,85	137/56	58/39	0,30/0,20	436/431	0,68/0,65
Limestone Alps and Inner Carpathian zones Závod-78, 75, 74, LNV-7, Kuklov-3, Studienka-83, Šaštín-12, Borský Jur-19	4405/4330	1,96/0,80	79/65	90/73	0,30/0,20	447/443	0,90/0,80
Eggenburgian Hrušky-33, 234, Šaštín-12	2592/2420	0,430/,50	95/77	89/89	0,06/0,02	433/432	0,57/0,61
Ottnangian Týnec-13A, 30, 4a, 82, 77, 83, Hrušky-228, 227, 230A, 84, 85, 86, 103, 106, 234	1122/831	0,87/0,90	492/399	73/69	0,30/0,11	403/431	0,46/0,46
Karpatian Hrušky-228, 45, 8, 220, Kuklov-3, 226A, 227, 2A, 72, 75	2379/1840	0,66/0,60	115/111	105/109	0,09/0,08	435/434	0,63/0,63
Badenian Hrušky-228, 188, 186, 152, Z-39, 35, 34, 223, 224, 231, 3, Břeclav-26, Lednice, 8, 9, Poddvorov-73	1955/1780	2,09/0,50	217/101	140/127	0,15/0,06	426/431	0,53/0,48
Sarmatian Hrušky-234	960	0,20	1854	541,0	—	442	—

In our opinion, processes of oil origin play a decisive role in the formation of the present physico-chemical composition of the oils. These processes are controlled by chemical reaction kinetics determined by thermodynamic laws. In this sense, the conversion of kerogen to oil hydrocarbons and the evolution of the latter imply the reduction of the available free energy of the molecules. Among the oil hydrocarbons, the energetically highest position is occupied by hydrocarbons of aromatic structure; an intermediate position has been assigned to cycloalkane (naphthene) hydrocarbons, while saturated paraffinic hydrocarbons dispose of the least amount of free energy. In accordance with thermodynamic calculations, aromatic hydrocarbons can be assumed to convert to cycloalkane hydrocarbons by way of hydrogenation as follows:

1. $C_6H_6 + 3H_2 \rightarrow C_6H_{12}$
   or, vice-versa, by dehydrogenation to high-molecular aromatics in accordance with equation
2. $2C_6H_6 \rightarrow C_6H_5 \rightarrow C_6H_5 + H_2$
   Reaction 1 yields cycloalkane hydrocarbons that, by way of hydrogenation give paraffinic hydrocarbons after equation 3:

Table 2 PRINCIPAL PHYSICO-CHEMICAL PARAMETERS OF THE OILS OF CZECHOSLOVAK DEPOSITS

Stratigraphy	Depth	Number of analyses	Spec. gravity g/cm³ 20° C	Resins	Asphalt.	Composition by structure and type			Composition by fractions 200—350 °C					
				% by mass					200—300 °C			300—350° C		
						CP%	CN%	CA%	CP%	CN%	CA%	CP%	CN%	CA%
Sarmatian	68—1246	217	0,930	10,1	10,4	29,3	53,2	17,5	26,5	67,5	7,0	28,9	57,5	13,6
Middle-Upper Badenian	441—3147	307	0,860	3,8	5,4	50,4	35,1	14,5	45,7	54,4	8,9	49,7	38,3	12,0
Lower Badenian	1102—1834	25	0,840	2,7	6,3	58,9	30,0	11,1	62,0	33,3	4,7	59,0	35,5	5,5
Karpatian	356—2456	113	0,880	2,8	7,5	43,5	42,1	14,4	47,6	42,8	9,6	47,0	39,8	13,3
Eggenburgian Ottnangian	362—2599	35	0,891	6,5	2,0	41,7	40,9	17,4	41,0	45,2	13,8	41,0	43,2	15,8
Eggenburgian	696—2085	5	0,875	3,4	6,0	38,9	45,8	14,4	27,5	68,9	3,6	30,1	63,0	6,9
Carpathian Flysch	206—2193	28	0,843	6,4	6,6	56,8	28,2	16,0	61,4	27,2	9,3	59,5	27,1	13,4

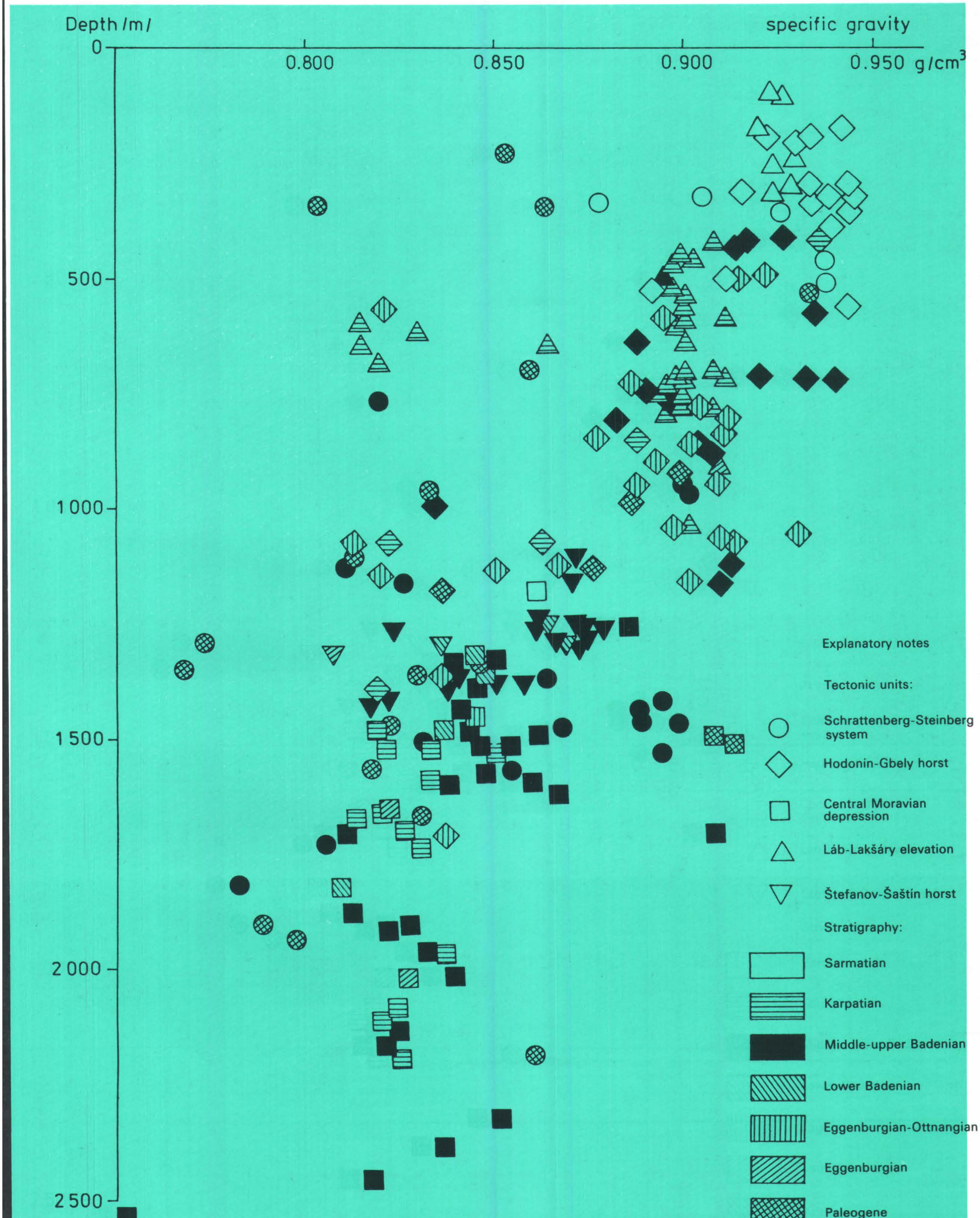


Fig. 4: Specific gravity values as a function of depth.

3. $C_6H_{12} + H_2 \rightarrow C_6H_{14}$

Dehydrogenation, in contrast with results in the condensation of aromatic cores, in the increasing number of C=C bonds and the generation of high-molecular aromatics and graphite formation in the final stage. Hydrogenation is conditioned by the supply of hydrogen released from dehydrogenated aromatics or by hydrogen disproportionation in hydrocarbon molecules.

Cycloalkane hydrocarbons (naphthenes) are, by their amount of free energy, nearer to paraffinic hydrocarbons (benzene 124.10^6J/mol, cyclohexane 24.10^6J/mol and hexane $4.3.10^6$J/mol). In accordance with the thermodynamic schemes, cycloalkane hydrocarbons cannot be generated by dehydrogenation of paraffinic hydrocarbons, as, for instance, demonstrated by equation 4:

4. $C_6H_{14} \rightarrow C_6H_{12} + H_2$

nor can they form in greater amounts by the hydrogenation o aromatics. The source of polycyclic cycloalkanes appears to consist in carbocyclic and heterocyclic structures derived from organic molecules of decayed biologic matter (proteins, carotenoids, pigments and other structures). By contrast, cycloalkane hydrocarbons readily lose hydrogen giving rise to aromatic hydrocarbons or, on the other hand, they yield paraffinic chains by hydrogenation. The strength of the C-C and C-H bonds rapidly declines with the increasing molecular mass of the individual members. The increase in energy level during the generation of aromatic cycles is offset, in the molecules, by decreasing the energy released owing to the decomposition of cycloalkane structures and the formation of paraffinic chains. Characteristic of the conversion (evolution) of paraffinic hydrocarbons is the decomposition of thermodynamically less stable high-molecular individuals to low-molecular hydrocarbons and carbon.

5. $C_nH_{2n+2} \rightarrow CH_4 + C + C_{n-2}H_{2n-2}$

The decomposition sequence of the individual hydrocarbon structures is governed by their bond strenght.

Considering the grade of katagenic metamorphism of dispersed organic matter, we may assume that most of the oils of the Vienna Basin have formed in the deeper-seated underlying strata. However, if accepting this affirmation, the explanation of the present chemistry of the oils in the stratigraphical profile of the Tertiary basin fill remains problematic. If admitting that the origin of oil hydrocarbons and their conversion were natural processes objectively governed by generally accepted laws, then the conversion of kerogen to oil hydrocarbons would be primarily controlled by the laws of the thermodynamic equilibrium of compounds; secondary effects accounting for the chemical composition of the oil hydrocarbons generated are migration differentiation controlled by the principles of frontal and displacement chromatography, microbial degradation, underground aeration, etc. The decisive factors of these processes are undoubtedly geological ones. The earlier concept of an autochthonous origin of oil in the deposits of the Tertiary basin fill presented by V. Šimánek (1976) is questionable. For deposits at shallower depths (3 to 4 km), owing to the results of new investigations that base primarily on the grade of katagenic metamorphism of organic matter. However, if accepting the origin of oil in the underlying sequences, we are not able to adequately explain their present physicochemical composition and, particularly, the formation of n-paraffines, the occurrence of the perylene type and their decomposition in the horizontal plane and in the depth section through the basin. Considering these facts, the questions related to oil origin in the Tertiary deposits of the Vienna Basin cannot be thought to have been answered in a satisfactory way. For this reason, this problem deserves our constant attention.

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Table 3 — **N-ALKANES IN THE OILS OF CZECHOSLOVAK DEPOSITS**

Depth interval	n-alkanes in oils % by mass	% Cn H_{2n+2} in n-alkanes																						
		C_9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Sarmatian 100—380	0,09	—	—	—	0,1	0,1	1,7	5,1	9,0	16,3	17,3	13,5	10,5	7,6	7,6	4,5	4,5	4,1	2,5	2,3	1,9	2,1	1,2	1,4	—
Upper Badenian 771—1856	20,4	0,8	2,4	3,7	5,0	5,6	6,8	8,4	7,8	7,3	6,7	6,4	6,4	5,0	5,0	4,4	3,7	3,1	2,8	2,2	1,9	1,6	0,9	0,7	0,5
Lower Badenian 1485—1578	19,0	0,4	1,2	2,1	3,0	3,5	4,2	6,9	8,5	8,0	7,7	6,7	5,8	5,5	5,0	4,5	3,9	3,5	2,8	2,4	2,3	1,2	1,0	0,5	—
Karpatian 1608—1917,5	10,0	—	—	—	5,2	7,3	7,9	7,6	8,5	7,2	6,3	6,5	5,8	5,0	4,7	4,5	4,2	3,9	3,1	2,9	2,2	2,0	1,6	1,4	0,7
Eggenburgian 865—1761,5	7,8	0,2	0,6	2,2	2,6	3,2	4,8	6,2	7,9	9,9	6,2	8,4	8,7	6,8	6,3	5,6	4,2	3,6	3,1	2,3	1,9	1,5	1,4	0,6	0,4
Paleogene 1070,5—1180	6,2	—	—	—	1,8	4,4	8,8	10,2	12,2	9,7	7,6	8,2	6,3	4,8	4,0	4,4	3,4	3,2	2,4	2,1	1,6	1,3	1,2	0,9	0,4

Abstrakt

Geneze ropy a zemního plynu v terciérních sedimentech čs. části vídeňské pánve je řešena na základě studia úrovně katagenní přeměny rozptýlené organické substance a chemického složení těžených rop. Jsou konfrontovány výsledky výzkumu těmito metodami. Úroveň katagenní metamorfózy oganické substance uvažovaných matečných hornin odpovídá ropnému oknu v hl. cca 3 — 6 km. Organická hmota je převážně III., v menším množství i II. genetického typu. Těžené ropy mají různorodé složení, vázané na jednotlivá stratigrafická souvrství; velmi lehké ropy parafinického, resp. parafinicko-naftenického typu jsou vázány na sedimenty badenu a paleogenní sedimenty magurského flyše, velmi těžké ropy naftenického charakteru na sarmat a ropy lehké až těžké, smíšeného parafinicko-naftenického a naftenicko-parafinického typu se vyskytují v karpatu a eggenburgu až ottnangu. V ploše jednotlivých souvrství je zřejmá závislost chemického složení rop na tektonické příslušnosti hornin. Termodynamika konverze kerogénu matečných hornin a sekundární diferenciace chemismu rop objasňuje přijatelným způsobem genezi ropných uhlovodíků v terciérní výplni pánve; předpoklad však zpochybňuje úroveň katagenní metamorfózy organické substance, kterou je třeba klást do podložních sérií, pravděpodobně do jury. Objasnění geneze přírodních uhlovodíků je třeba věnovat nadále patřičnou pozornost.

Zusammenfassung

Die Frage der Erdöl- und Erdgasgenese in tertiären Sedimenten des tschechoslowakischen Teils des Wiener Bekkens wird aufgrund der Untersuchung des Niveaus der katagenen Umwandlung verstreuter organischer Substanz und der chemischen Zusammensetzung des geförderten Erdöls gelöst. Im vorliegenden Beitrag werden Ergebnisse dieser Untersuchungsmethoden einander gegenübergestellt. Das Niveau der katagenen Metamorphose der organischen Substanz in betreffenden Muttergesteinen entspricht dem Erdölfenster in einer Tiefe von 3 bis 6 km. Die organische Substanz ist vornehmlich von III., in einer kleineren Menge auch von II. genetischem Typ. Das geförderte Erdöl weist eine verschiedenartige Zusammensetzung auf, die an einzelne stratigraphische Formationen gebunden ist; sehr leichte Erdölarten mit Paraffin- bzw. Paraffin- bis Naphthenbasis sind an die Baden- und Paläogensedimente des Magura-Flysches, sehr schwere naphthenbasische Erdölarten an das Sarmat gebunden, und schließlich leichte bis schwere Erdölarten von gemischtem paraffin-naphthen- bzw. naphthen-paraffinbasischem Typ kommen im Karpat und Eggenburg-Ottnang vor. In der Flächenausdehung einzelner Schichtenfolgen kommt eine Abhängigkeit der chemischen Erdölzusammensetzung von der tektonischen Zugehörigkeit der Gesteine zum Vorschein. Durch die Thermodynamik der Kerogenumwandlung in Muttergesteinen und die sekundäre Differentiation des Erdölchemismus wird die Genese der Erdölkohlenwasserstoffe in der tertiären Beckenfüllung auf eine annehmbare Weise gedeutet; die Annahme wird allerdings durch das Niveau der katagenen Metamorphose der organischen Substanz fraglich, das in unterlagernde Serien, wahrscheinlich in den Jura, zu stellen ist. Der Frage der Genese natürlicher Kohlenwasserstoffe soll auch weiterhin besondere Aufmerksamkeit zugewendet werden.

OCCURRENCES OF NATURAL HYDROCARBONS AT THE VARISCAN LEVEL OF THE CENTRAL AND ADJACENT SOUTHERN PARTS OF SOUTHEASTERN SLOPES OF THE BOHEMIAN MASSIF

Hedvika Thonová — Stanislav Benada
Moravian Oil Company

For many years now, the Moravian Oil Company has been prospecting for natural hydrocarbons at increasing depths and under increasingly complicated geological conditions. The exploration programme also includes deep boreholes on the southestern slopes of the Bohemian Massif, the purpose of which is to investigate the Variscan platform and its sedimentary mantle. These boreholes have recently discovered many deposits, some of them accumulated in Paleozoic sediments of the platform mantle.

The basement of the area of interest is composed of plutonites and metamorphosed sedimentary series. The Cadomian-consolidated basement is overlain by a Variscan platform mantle represented by Paleozoic rocks. As to younger formations, Mesozoic and Paleogene rocks are known to occur expecially in the southern part of the area. The northwestern part is occupied by the Carpathian Front Foredeep. Most of the area has been covered by flysch nappes of the Outer Carpathians.

Paleozoic sediments have been confirmed by boreholes especially on the high block of the longitudinal step parallel to the Carpathians, which is manifested very significantly in the central part of the slopes. According to the lateral classification of the Variscan Level, the area comprises the eastern edge of the Moravian Karst, Drahany Highland and Šlapanice Blocks (J. Dvořák 1978). The deeply submerged parts of the platform in the central section have not been verified, as the surface of autochthonous sediments is situated at depths from 4,000 to 5,000 metres there. Fairly high preserved thicknesses of Paleozoic rocks have been confirmed in sunken blocks perpendicular to the Carpathians, especially those of Nesvačilka, Měnín and Němčičky (J. Adámek, J. Dvořák, J. Kalvoda, 1980, J. Adámek — manuscript), where they constitute significant transversal elements of post-sedimentary tectonics.

Stratigraphic and lithologic development

The peneplained, highly complex relief composed of crystalline rocks is overlain by a basal clastic sequence of the Old Red facies (Eifelian-Givetian). It is represented by variegated terrestrial clastic sediments, in younger parts intercalated by variegated pelites. Its lithological development is relatively uniform, the thickness very variable, ranging from 10 to 1,700 m.

The sedimentary cycle continues by a carbonate facies during the Frasnian to Upper Fammenian, with local partial hiatuses. The transition between the basal clastics and pure carbonates is represented by reef dolomites and dolomitic limestones containing a terrestrial component (Eifelian — Givetian). A marine transgression during the Lower Frasnian is characterized by grey, massive, micritic and biomicritic limestones. Since the Upper Frasnian, the sea has been getting shallower, the process being associated with the deposition of light-coloured, sand- and clay-containing limestones, often with layers of clastics indicating an extensive sea regression. Between the Upper Fammenian and the Middle Viséan, there is a stratigraphic hiatus in most of the area, especially in deeper parts of the platform. A new transgression takes place from the Middle till Upper Viséan, manifested mainly by a carbonate facies, sometimes alternating with a Culm facies, sometimes the two facies laterally substituting each other. The carbonate facies