

**COMPREHENSIVE RESULTS
OF CZECHOSLOVAK-AUSTRIAN COOPERATION
IN OIL AND NATURAL GAS SURVEYING**

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The Austrian and Czechoslovak geological schools are traditionally interdigitated. This has its deep historical roots and logical reasons. In this respect oil geology is a relatively young field, dynamically developing since 1913, the year we date the start of systematic oil and natural-gas surveying in the Vienna Basin. But expensive and systematic cooperation did not begin until after the second world war. The legislative platform was the Agreement of the 23rd of January 1960 between the government of the Czechoslovak Socialist Republic and the Austrian federal government on principles of geological cooperation between the Czechoslovak Socialist Republic and the Austrian Republic. The Czech Geological Office in Prague and the Federal Geological Institute in Vienna were charged with the practical implementation of the agreement. The agreement covered the entire sphere of cooperation between the two sovereign countries in geological sciences, in particular in deposit application. A significant part of the agreement, though, was assigned to oil geology and geophysics. Thus a significant legislative base for cooperation was established, enabling for the first time a systematic development of mutually advantageous collaboration and later also cooperation.

The field of data exchange and cooperation between CSSR and Austria is a broad one, because the main zones important for exploration of hydrocarbons are extending from one country into the other: the Vienna Basin, the Molasse Zone, the external Zone of the Carpathians, the Calcareous Alpine nappes buried underneath the Vienna Basin and finally the autochthonous sedimentary cover of the Bohemian Massif, extending from the Molasse eastward far underneath the Vienna Basin. In the sixties and the beginning of the seventies the cooperation proceeded predominantly in the form of a mutual exchange of documentation and geological-geophysical information. The exchange of maps of the progress of exploration work became the foundation. Thus a state of progressive collaboration was achieved, gradually changing into cooperation. This desirable condition was reached at the end of the seventies and in the eighties. Here it is necessary to mention the prominent personalities who deserve credit for this desirable situation. They are Dipl. Ing. Dr. H. Spörker and Dr. Kröll from the national enterprise ÖMV Wien and the chairman of the Czech geological Office Prague, Dr. Pravda, whose purposive work led to very open and mutually advantageous relations. We now return to at least the main aspects of the cooperation and the achieved results.

As it has already been mentioned the mutual exchange of information was the first and very important stage of cooperation. The conditions for the mutual coordination of exploration work were thus established. Already this basic factor indisputably led to a considerable increase of the efficiency of the exploration work in both countries, consistent in the gradual elimination of mutual duplicities. With regard to the advanced state of the exploration of the Neogene filling of the Vienna Basin a great quantity of information was obtained in this area. Both parties paid great interest to the exploration of the basal Miocene and to observing the industrial accumulation in the vicinity of the state border in the entire Neogene sequence. On the method of solution of the Neogene problems, primarily with regard to structural, stratigraphical and other aspects, it was necessary to elaborate joint stratigraphical and logging-interpretation criteria as a foundation for drawing up joint structural maps. It was indisputably a very exacting complex of work, a successful accomplishment of both parties.

Finally, it was possible to proceed with the drawing up of joint structural maps, e. g. for the upper boundary of the Sarmatian for the boundary between the Badenian and Karpatian, etc. Gradually a state was reached when also the problems of the course of main tectonic line were solved, e. g. the Steinberg Fault, the Hrušky-Lanzhot Fault, the Farský Fault, etc.

The gradual modernization of seismic measuring was logically succeeded by the phase of a systematic tracing of lithologically limited deposits. A significant representative of such deposits is the Gajary oil field in the upper Badenian. This result enabled the development of seismic and drilling work on the Austrian side of the state border, which proved that this deposit does not continue on Austrian territory, but at the same time this result led to the intensified tracing of such deposits in Austria, and after mutual consultations, interpretational procedures of seismic data for the solution of complicated structural types of traps were established.

Undoubtedly further significant cooperation progressed with the exploration of the Alpine substratum of the Vienna Basin. In this respect remarkable results were achieved in Austria already at the close of the fifties and beginning of the sixties in the exploration of the morphological structures of the Limestone Alpine Zone and in their inner structure. Surveying of this type belongs in all respects to the most demanding, not excluding economic aspects. In particular the discovery of the Schönkirchen deposit is an excellent example of the complex solution and mastery of these problems. In Czechoslovakia this type of surveying was started later — it was only developed at the close of the seventies and in the eighties. The best results so far were on the morphological and litologically combined structure Závod in the surface of the Limestone Alpine Zone. Encouraging results were also achieved in the inner litologically limited dolomite bodies on the Závod and Šaštín structures. At this stage of exploration it was possible to proceed with the drawing up of joint structural maps of the pre-Neogene relief with coordination of the tectonic elements, including deep tectonics, and with the composition of joint geological cross-sections.

Another extensive sphere of cooperation is in the exploration of the autochthonous sedimentary mantle of the Bohemian Massif the Neogene frontal and Mesozoic platform cover. Here it is particularly necessary to mark out the exploration of the Steinberg dome in Austria, the wells in Zistersdorf UT—1 (7544 m) and 2A, where the deepest oil-well drilling in Europe (8573 m) was achieved. Beside the exploration of this structure exploration of other areas progressed, e. g. Maustrenk UT—1 in Austria, Sedlec 1, Nové Mlýny — 1 and 2 in Czechoslovakia and some others. But important, economically interesting results have not yet been achieved, because of the fact that the reservoir rocks, that have been established underneath the Czechoslovakian and Austrian Foredeep of the Carpathians were not encountered till now. An isopach map drawn on the base of deep wells in both countries of the main source rock, the autochthonous Malmian Basin marls with their large thickness and their high organic content encourages to a continuation of deep exploration in the Vienna Basin in future time.

For the development of the systematic exploration of the Mesozoic platform it was necessary to elaborate also a joint stratigraphical nomenclature, the principles of which were accepted by both parties as the basic norm.

A similar procedure was used in the exploration of the Molasse Zone of Carpatian Foredeep where a discovery was made of a not very extensive common gas accumulation in the Rzehakia (Oncophorn) beds (Alt Prerau — Nový Přerov). Joint structural maps and geological cross-sections were also drawn up of these areas.

Seismic measuring became a very significant factor of the cooperation. Here, coordination was led in two directions — on the one hand by the subcommittee for geophysi-

cal work between Geophysics ÖMV and Geophysics Brno, on the other hand between MND Hodonin and the department of geology of the ÖMV Vienna. The result of this activity was the establishment of a network of regional and, in some areas, of detailed seismic measuring. Thus, after the jointing of also the methodic and interpretation principles, a long-term foundation was laid for the orientation of surveying work with marked effectiveness for both parties. Today, consequently, there is a network of seismic cross-sections, constituted without regard to the course of the state borders.

The most recent example of cooperation in seismic investigation in the borderzone between Austria and CSSR is the common 30 acquisition in the area of Rabensburg — Lanžhot which will be followed by a common interpretation of the data obtained.

Today, mutual cooperation concerns practically all the spheres of the process of tracing deposit traps. Here we must mention, for instance, other cooperation in the methodology of tracing deeply deposited structures and also the solution of the technical problems involved with such surveying. Jointly solved are problems concerning the genesis of hydrocarbon in laboratories in Czechoslovakia and in Austria, an intensive exchange of rock core samples is being carried out for checking analyses, there is an exchange of geophysical drilling data, both parties enabled excursions of specialists, there is an exchange of some supporting projects and attendance at professional seminars and symposiums is made possible.

The achieved standard of cooperation is indisputably a good promise also for the coming years. Both parties express sincere interest to further develop professionally established principles of coordination, bringing indisputable effect in the sphere of application and economic rationalization.

A further intensification of the cooperation also has its material reasons. It will certainly touch upon methodic problems, geological studies and the critical assessment of significant projects. We see, without doubt, considerable resources in the sphere of natural-gas storage and the relevant geological deposit work, etc. In retrospect, the past years of cooperation have fully confirmed the justification to continue to build our mutual relations on the highest concrete professional principles that bring both parties the greatest effect.

At the same time they are also an expression of the good relations between two neighbouring countries.

Eingeschätzt wird auch das Gebiet der Methodik und Interpretation seismischer Arbeiten, der Methodik zur Ermittlung sehr tief gelagerter Strukturen und Akkumulationsbedingungen.

FACIES DEVELOPMENT OF MIOCENE FORMATIONS IN THE SOUTHWESTERN PART OF THE CARPATHIAN FOREDEEP AND ITS OIL AND GAS PROSPECTS

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1. Introduction

On the basis of reflection-seismic prospecting conducted by the CGG Company with the aid of Vibroseis techniques in 1979, Altprerau-2 borehole in the Altprerau region in Austria brought evidence, in 1981, of a natural gas deposit in Karpatian sandstone horizons and in the Oncophora Beds of the undisturbed molasse. The extension of the gaseous hydrocarbon deposit into Czechoslovakia was confirmed by Nový Přerov-3 borehole.

The common Czechoslovak and Austrian Nový Přerov — Altprerau natural gas field is situated in the southeastern part of the Carpathian Foredeep, southeast of the village of Nový Přerov on Czechoslovak territory and southeast of the village of Altprerau in Austria (Fig. 1). The geologic structure of the region comprises Quaternary and Karpatian sediments in its upper sections and, in the west, with Lower Badenian sediments on the top. The gas accumulations lie in Karpatian sandstone horizons of basal clastic development in Oncophora horizons NNo 1, 2, 4 (in Austria, the whole basal sedimentary complex has been assigned to the Ottnangian — Oncophora Beds) and in the schlier (clay marl) development of the Karpatian. The geological data obtained as a result of geophysical prospecting and exploratory drilling were evaluated by Austrian and Czechoslovak geologists and, by agreement, Oncophora horizons 1, 2, 4 were defined as the common gas-bearing formation.

During the subsequent stage of reflection-seismic prospecting in the Neuruppersdorf and Pottenhofen areas in Austria, additional structures in Miocene sediments were discovered and delineated. The presence of gas in these structures was proved by Neuruppersdorf-1, Pottenhofen 2 and Pottenhofen-3 boreholes. The gas accumulations occur in Karpatian sandstone horizons (Oncophora Beds). The upper part of a Jurassic formation composed of light to dark grey limestones deposited in a favourable tectonic setting was found to be gas-bearing in Pottenhofen-2 borehole.

2. Stratigraphy and lithology

The Nový Přerov-Altprerau, Pottenhofen and Neuruppersdorf gas occurrences are localized in the southeastern part of the Carpathian Foredeep. The surface formations include Quaternary, Karpatian and Lower Badenian sediments; the Miocene sedimentary basin is underlain by Mesozoic, particularly Jurassic sediments represented by a carbonate facies gradually passing into a pelite-carbonate facies east of the localities mentioned above. The fill of the Carpathian Foredeep consists, from the underlying to the overlying formations, of Egerian, Eggenburgian, Ottnangian, Karpatian and Lower Badenian sediments.

Abstrakt

V příspěvku je podán ucelený přehled a výklad ke spolupráci mezi ČSSR a Rakouskem v oblasti naftového průmyslu. Jsou zde vzpomenuy hlavní výsledky této spolupráce, která postupně přecházela od vzájemné výměny informací do fáze sestavování společných geologických map a profilů včetně interpretace strukturálních a tektonických elementů.

Obzvláště vysokého stupně spolupráce bylo dosaženo v lokalitách společných ložisek, resp. v oblastech potenciální existence společných perspektivních strukturálních objektů pro průmyslové akumulace přírodních uhlovodíků.

Zhodnocena je též oblast metodiky a interpretace seismických prací, metodiky vyhledávání velmi hluboko uložených struktur a akumulací podmínek.

Zusammenfassung

Im Beitrag wird eine in sich abgeschlossene Übersicht und Erörterung der Zusammenarbeit zwischen der ČSSR und Österreich auf dem Gebiet der Erdölindustrie geboten. Es werden hier Hauptergebnisse dieser Zusammenarbeit erwähnt, die sich allmählich von einem gegenseitigen Informationsaustausch zur Phase der Zusammenstellung gemeinsamer geologischer Karten und Profile einschl. der Interpretation von Struktur- und tektonischen Elementen entwickelten.

Ein besonders hohes Niveau der Zusammenarbeit wurde an Fundorten erreicht, wo sich gemeinsame Lagerstätten bzw. mögliche gemeinsame perspektivische Strukturobjekte vorfinden, die förderwürdige Akkumulationen natürlicher Kohlenwasserstoffe enthalten können.