

**DEEP SEISMIC SOUNDING
IN THE EASTERN PART OF THE PANNONIAN BASIN ALONG
THE INTERNATIONAL PROFILE XI
FOR THE INVESTIGATION OF THE EARTH'S CRUST,
CONDUCTED BY HUNGARIAN AND ROUMANIAN PARTIES
IN CO-OPERATION**

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Introduction

The sections of the international Earth's crust profiles within the frontiers of the different countries are connected by co-operation measurements near the frontier. By means of these measurements it is possible to correlate and uniformly interpret the boundaries of the respective profile sections (MITUCH, 1968; SUBBOTIN et al, 1970).

In 1973, Hungarian and Roumanian geophysicists carried out such joint seismic measurements along the XI international profile (Fig. 1). The measured section of the profile fell between Hotar (Roumania) and Nagyrábé (Hungary). According to the coordinated plan there were two shotpoints on the line: one of them in the proximity of Hotar, the other of Nagyrábé, with a distance of 71 km between them. Observations along the profile were continuous—not regarding several interruptions.

Observation on the Hungarian side was carried out by two equipments, one with digital (SDT-2) and one with analog recording on magnetic tape (SZM-26 + 6), using 5 cps geophones. On the Roumanian side an analog equipment type POISK-K.M.P.V. was used with 10 cps geophones. Geophone spacing on either sides was 100 m.

Characteristics of the waves

In course of the measurements arrivals were obtained from the crystalline basement (P_0^K), from three intermediate boundaries (P_1^K, P_2^K, P_3^K)— P_2^K corresponding probably to the Conrad discontinuity—and from the Mohorovičić discontinuity (P^M ; Fig. 2).

Waves P_0^K are regarded as refracted waves, whereas waves P_1^K, P_2^K, P_3^K may be both refracted and reflected ones, since the broken time-distance curves do not allow the exact determination of their nature. Waves P^M are probably all reflected even beyond the critical distance. This is suggested by the curvature of the time-distance curves.

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Manuscript received: 5, 3, 1975

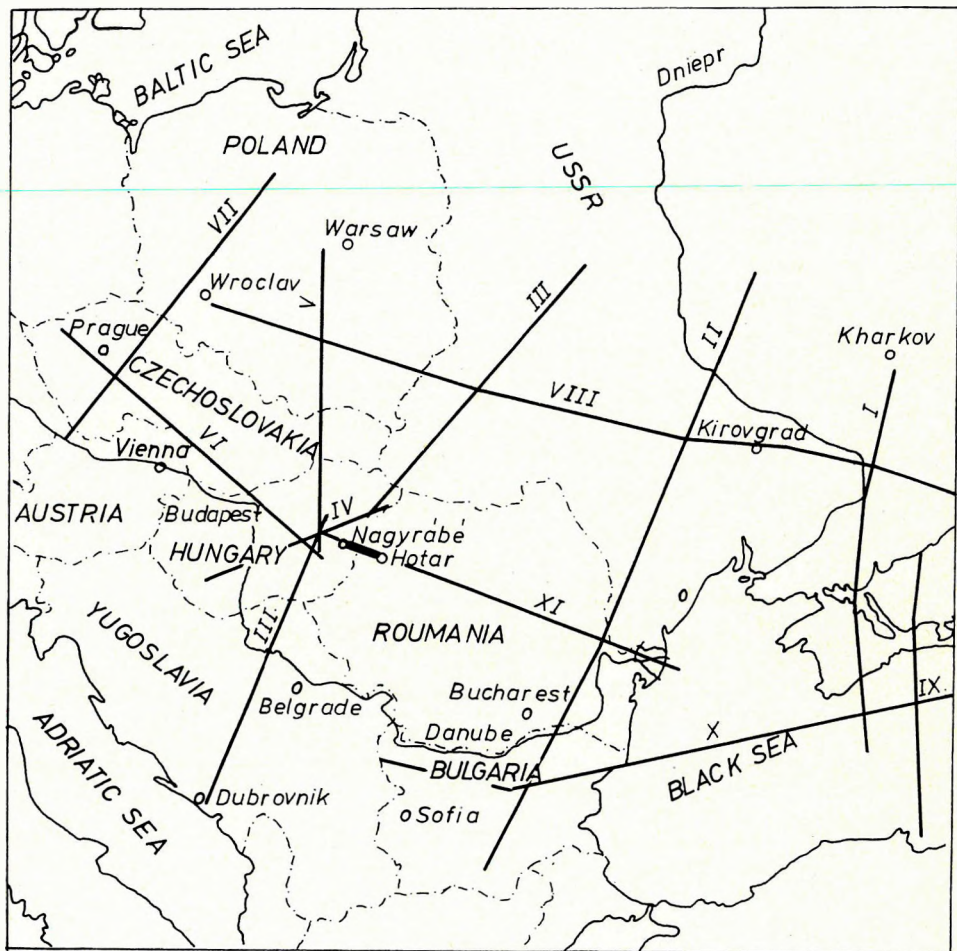


Fig. 1. Plan of the international Earth's crust profiles

I. ábra. A nemzetközi földkéregkutató vonalak helyszínvázlata

Рис. 1. План международного профиля по глубинному сейсмическому зондированию земной коры

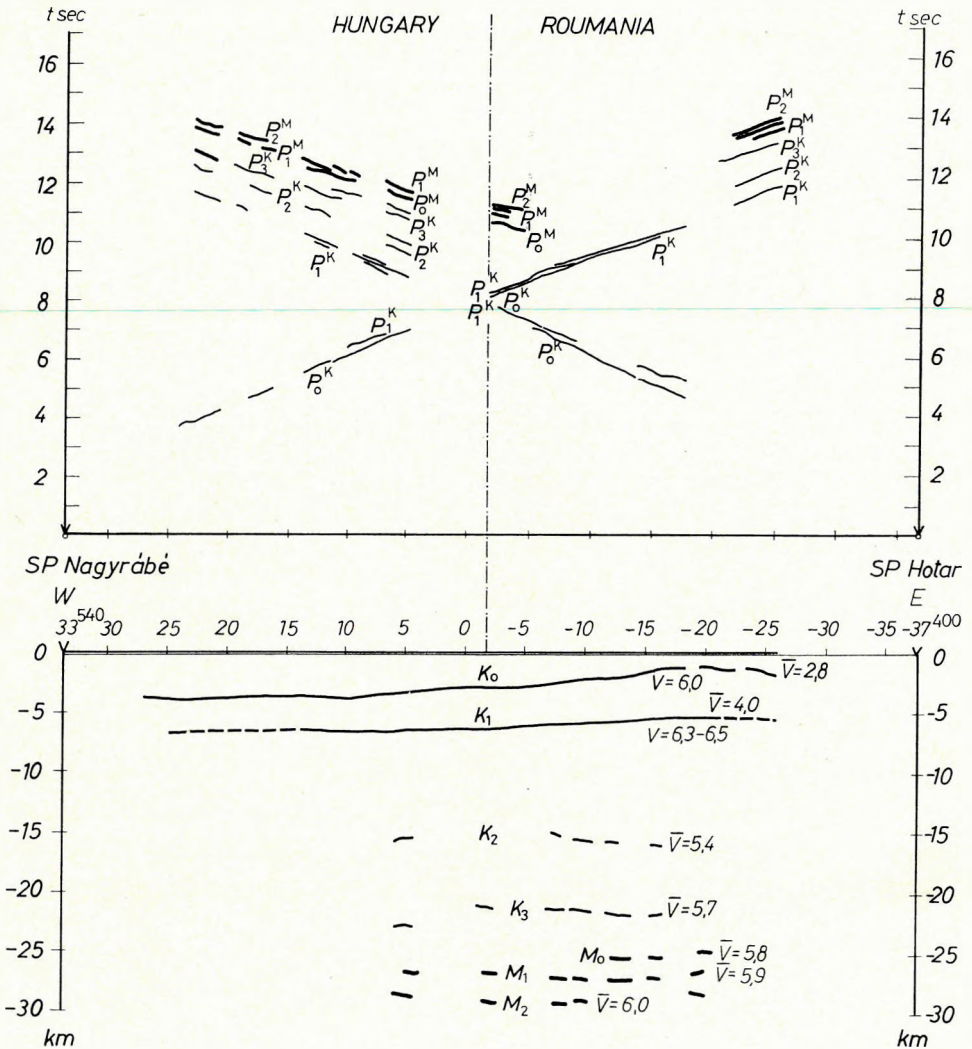


Fig. 2. Time-distance curve and section along a part of the international profile XI between Hotar and Nagyrábé

— · — · — · — Hungarian-Roumanian frontier

V boundary velocity in km/sec

\bar{V} average velocity in km/sec

33540, 37400 picket numbers refer to shotpoint distances: 33540 m resp. 37400 m

2. ábra. A XI. nemzetközi földkéregkutató vonal Hotar—Nagyrábé közé eső szakaszának út—időgörbéje és szelvénye

— · — · — magyar—román országhatár

V határsebesség km/sec-ban

\bar{V} átlagsebesség km/sec-ban

33540, 37400 karószámok, robbantópont távolságokat jelentenek: 33 540 m, illetve 37 400 m

Рис. 2. Годограф и разрез по участку международного профиля ГСЗ № XI между населенными пунктами Хотар и Надьрабе

Waves P^M appear as usual in two groups (P_1^M, P_2^M), where generally the energy of the second wave-group is greater (Fig. 3). At certain places there is one more wave (P_0^M) preceding the wave P_1^M , which comes probably also from the Mohorovičić discontinuity and seems to indicate the upper boundary of the transitional zone (Fig. 4).

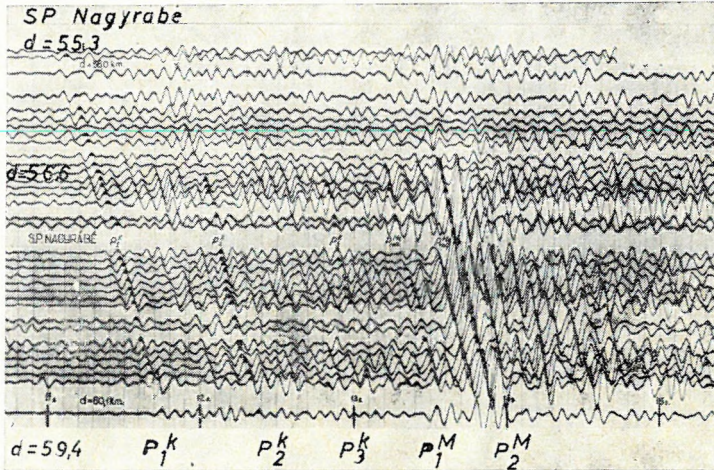


Fig. 3 Arrivals $P_1^K, P_2^K, P_3^K, P_1^M, P_2^M$ recorded from shotpoint Nagyrábé

3. ábra. A nagyrábéi robbantópontból készült felvétel $P_1^K, P_2^K, P_3^K, P_1^M, P_2^M$ beérkezésekkel

Рис. 3. Отражения $P_1^K, P_2^K, P_3^K, P_1^M, P_2^M$, полученные при взрыве в пункте взрыва Надьрабэ

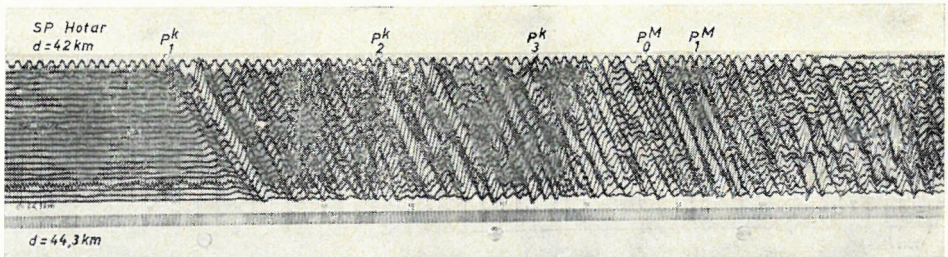


Fig. 4 Arrivals $P_1^K, P_2^K, P_3^K, P_0^M, P_1^M$ recorded from shotpoint Hotar

4. ábra. A hotari robbantópontból nyert felvétel a $P_1^K, P_2^K, P_3^K, P_0^M, P_1^M$ beérkezésekkel

Рис. 4. Отражения $P_1^K, P_2^K, P_3^K, P_0^M, P_1^M$, полученные при взрыве в пункте взрыва Хотар

It should be observed, that on the records from shotpoint Hotar, reflections from the Mohorovičić discontinuity appear even within the critical distance and can be followed from 33.5 km onward (Fig. 2). On the records from shotpoint Nagyrábé, reflections from the Mohorovičić discontinuity appear abruptly, with high energy at the critical distance (56.6 km; Fig. 3).

Waves P_2^K do not appear continuously and usually have low energy. Therefore their tracing is questionable (Figs. 3 and 5). The above phenomenon leads to the con-

clusion, that the Conrad discontinuity (if waves P_2^K can be related to it) does not represent such a sharp boundary, as in other parts of the profile (as e.g. in the foreland of the Carpathian Mountains and in the area of the Transylvanian depression).

Noteworthy is the very high-intensity multiple (reflected-refracted) P_{mult} wave seen on Fig. 6, which can be traced from 36 km to 49 km. The time-distance curve of these arrivals is parallel to that of the primary, which proves decisively their multiple character.

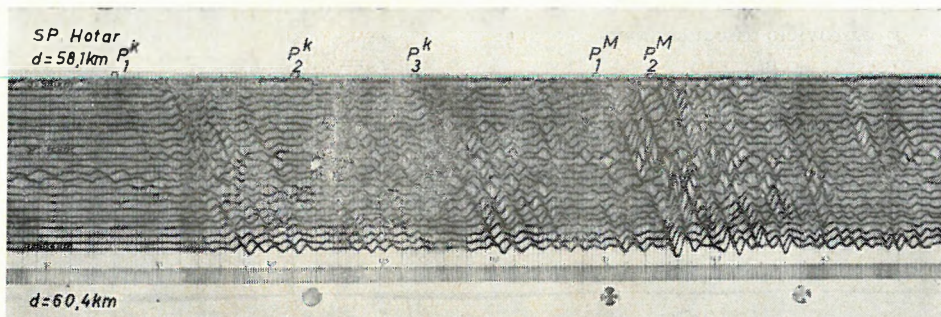


Fig. 5 Arrivals P_1^K , P_2^K , P_3^K , P_1^M , P_2^M recorded from shotpoint Hotar

5. ábra. A hotari robbantópontból készült felvétel a P_1^K , P_2^K , P_3^K , P_1^M , P_2^M beérkezésekkel
 Рис. 5. Отражения P_1^K , P_2^K , P_3^K , P_1^M , P_2^M , полученные при взрыве в пункте взрыва Хотар

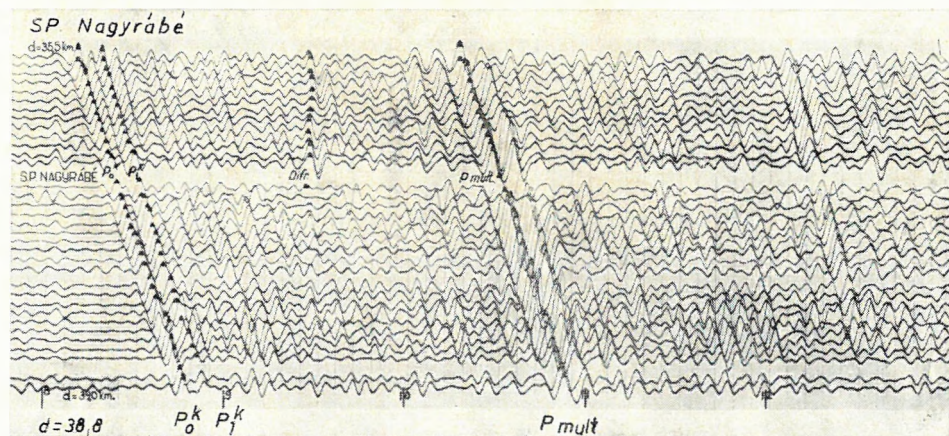


Fig. 6 Multiple arrivals recorded from shotpoint Nagyrábé

6. ábra. A nagyrábéi robbantópontból készült felvétel a többszörös (P_{mult}) beérkezéssel

Рис. 6. Кратные отражения, полученные при взрыве в пункте взрыва Надьрабе

Discussion

A section of the crust as constructed from the recorded wave-groups is presented on Fig. 2. Here the boundaries K_0 and K_1 have been plotted from the arrivals P_0^K and P_1^K by the isochron technique. The presumably reflected arrivals were con-

structed by the circle-segment method of PUZIREV to produce segments of the reflective horizon.

The individual boundaries were plotted with the following vertical velocities:

crystalline basement (K_0)	$\bar{V} = 2.8$ km/sec
intermediate boundaries:	
K_1	$\bar{V} = 4.0$ km/sec
K_2	$\bar{V} = 5.4$ km/sec
K_3	$\bar{V} = 5.7$ km/sec
Mohorovičić discontinuity	
M_0	$\bar{V} = 5.8$ km/sec
M_1	$\bar{V} = 5.9$ km/sec
M_2	$\bar{V} = 6.0$ km/sec

It can be seen on the section, that the deep horizons dip somewhat to East, in contrary to the topography of the crystalline basement.

The thickness of the crust—regarding the continuous boundary M_1 —averages up to 27 km. Such a thickness corresponds to the values obtained so far for the Pannonian basin. The depth of the horizon M_2 calculated from $P_{\frac{1}{2}}$ is larger by 2 to 2.5 km than that of M_1 .

The structure of the Earth's crust along the investigated profile shows a similar character to the picture obtained for the Pannonian basin (MITUCH, 1968).

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MAGYAR—ROMÁN KÖZÖS SZEIZMIKUS MÉLYSZONDÁZÁS A PANNON-MEDENCE K-I RÉSZÉBEN A XI. NEMZETKÖZI FÖLDKÉREGKUTATÓ VONAL MENTÉN

1973-ban a XI. nemzetközi földkéregkutató vonal mentén magyar és román mérőcsoportok közösen végeztek szeizmikus mélyszondázást a földkéreg felépítésének megismerésére. A cikk ismerteti a XI. vonal Hotar (Románia)—Nagyráb (Magyarország) közötti szakaszán végzett közös mérés eredményeit.

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ГЛУБИННОЕ СЕЙСМИЧЕСКОЕ ЗОНДИРОВАНИЕ В ВОСТОЧНОЙ ЧАСТИ ПАННОНСКОГО БАСЕЙНА ПО XI МЕЖДУНАРОДНОМУ ПРОФИЛЮ С ЦЕЛЬЮ ИССЛЕДОВАНИЯ ЗЕМНОЙ КОРЫ, ПРОВЕДЕННОЕ СОВМЕСТНОЙ ВЕНГЕРСКО-РУМЫНСКОЙ ЭКСПЕДИЦИЕЙ

В 1973 г. венгерской и румынской полевыми партиями проводились совместные работы по глубинному сейсмическому зондированию по международному профилю ГСЗ № XI для изучения строения земной коры. В настоящей работе описываются результаты совместно проведенных наблюдений по участку профиля между населенными пунктами Хотар (Румыния) и Надьрабе (Венгрия).