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THE ANALYSIS OF SUBSIDENCE ON THE FOREDEEP AREA OF THE EAST CARPATHIANS FORELAND BASIN, SUPERADJACENT TO THE BÂRLAD DEPRESSION

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In the east side of the Oriental Carpathians, the foreland basin was installed during the Badenian period from the north to the south, on very varied bedrock, result of the different geological evolution in time on this area.

Thus, in the north, up to Bistrita fault the bedrock is the most stable, representing the eastern extremity of the East – European Platform. The foreland basin formations are placed on different Cretacic elements that belong to the sedimentary layer of the platform. (Vinogradov et al.1983) The thickness of Neogene sediments compacted before the Carpathian interlacing in the area of maximum subsidence of the foredeep, has values of: 1430 m at Horodniceni, 2820 m at Buhusi, 2490 m at Bacau and it is represented only by the superior Badenian and the inferior and medium Sarmatian. The northern limit of the Chersonian is at the south of Bacău.

In the southern area, the bedrock belongs to the north –Dobrudja Paleozoic, being investigated through numerous drillings executed for hydrocarbons (Paraschiv et al.1983).Here, the Neogene sedimentation begins in the Sarmatian period, the thickness of compacted Sarmatian formations being : 1400 m at Burcioaia, 1200 m at Adjud, 1900 m at Conteşti, but the subsidence is active in the Pliocene too, the succession of sedimentary formations laid in this period of time having a considerable thickness of 2000-2500 m.

The bedrock of the central region comprised between the Bistriţa fault and Trotuş fault, contains sedimentary formations belonging to the Bârlad Depression, Jurassic in the southern half and Cretacic formations in the northern one. In this area, the stratigraphic succession is complete: Badenian, Sarmatian, Pliocene, the width of sedimentary multitude of the Neogene reaching here the highest values before the interlacing of Carpathian layers, respectively 4000-5000 m in the foredeep area.

The formation of these large widths is due to a higher subsidence rate on the area superposed to the Bârlad Depression. Here, the subsidence has two causes: one

similar to that at the north and south , respectively the installation of foredeep area of the foreland basin and the second which is due to the reactivation of major faults of the foredeep that plaid an important role during the evolution of Jurassic Depression, affecting even the crystalline basement (Polonic 1996) The crystalline basement is, according to geophysical data, at a depth of -6000 m in the eastern area and -8000 m in the western one, where the foredeep of the foreland basin was installed.

The geological section represented by us in the Figure 1, is made on a west-east alignment, superposed to the maximum subsidence axe of the Barlad Depression in the Jurassic. The foreland basin configuration is well emphasized , the subsidence being increased in front of the interlacing in the foredeep area, but the higher values both towards the north and towards the south are due to the reactivation of the bedrock' s faults.

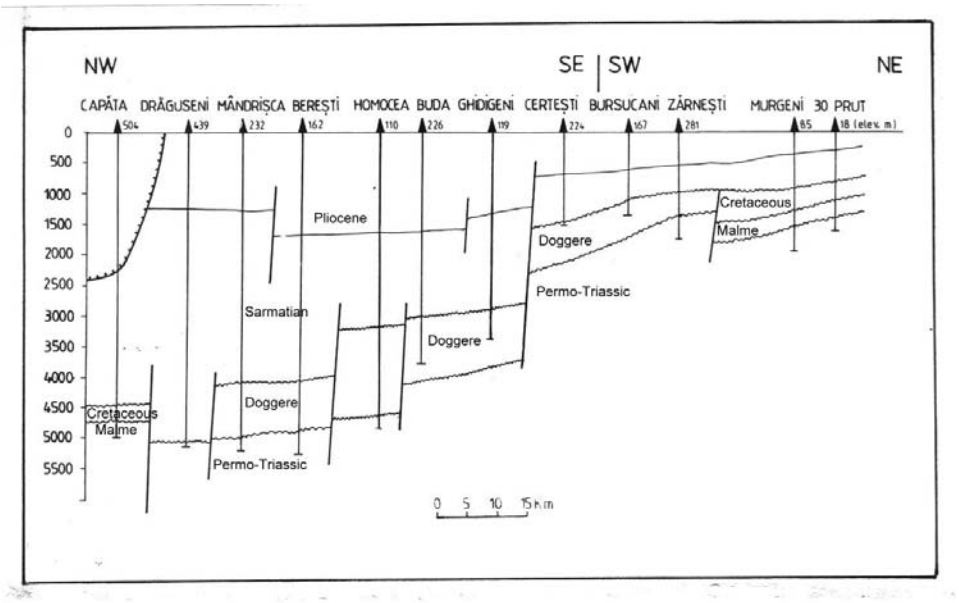

Fig. 1. West-East geological section, in the foredeep area of the foreland basin.

The Focsani depression situated at the south of the Trotus fault and at the west of Peceneaga-Camena Fault has known a special evolution, the neogene sedimentation arriving at 10000 m here; until now, it has been investigated up to this depth only from the geophysical point of view.

The seismic survey works were carried out during the period 1967-1993 and a structural map at the level of Badeian anhydrite landmark was drawn up. The anhydrite

formation is progressively buried at 1500 m in the north on the foredeep area, superposed on the platform up to 8000-10000 m in the south, at Focsani.

On the east-west section we made, we noticed a progressive increase of the widths of Prut formations (500-600 m) , representing the Sarmatian and the Pliocene, up to 2500-4000 m Sarmatian and 1600-1700 m Pliocene, in the foredeep area of the foreland basin , that we will discuss about in this paper.

We analyzed the results obtained for the cores extracted from the Sarmatian formations from 20 wells. From the stratigraphic point of view, the middle and inferior Sarmatian is separated from the superior one based on the microfaunistic associations with Gobius and Sphaeroidina moldavica and with the Paramysus. (I.C.P.P.G. Laboratory Bucharest). This separation is not made in all the wells, therefore we cannot appreciate how much of the Sarmatian width belongs to every interval.

We have separated four litological units, clearly identified in all the wells and we have created a litological column typical for this area, figure 2.

The Sarmatian starts with compact grey blackish argyles, with uncarbonized vegetal remains with intercalations of well cemented calcareous sandstone, with fine grain and joints filled with calcite. The sand stone percentage is small at Capăta, Mândrişca and Bereşti , in the deep area and increases up to 23-25%, at Homocea on the higher block.

Little by little, the sandstone predominates in all the wells compared to the black shale and another sequence is individualized, that has 650 m at Beresti, 500 m at Mândrişca, 300 m at Capăta and 400 m at Buda. On this interval, all the gas accumulations of the Sarmatian are installed.

The third sequence is remarked through the appearance of marls that alternate with the sand stones. The Pliocene is not investigated through mechanical cores, the sedimentary sequence being known according to the geophysical results and screen samples.

We carried out backstrip through the D1 method for three wells: Bereşti, Mândrisca and Homocea ; the analysis of subsidence and its results are presented in figure 3. The curves represent the total subsidence , 3a and tectonique subsidence, 3b. The curves represent the subsidence in the three points of the basin.

The compacted widths of the whole sedimentary sequence are : 3220 m at Homocea, 4185 m at Mândrisca and 4210m at Bereşti ; the decompacted ones resulted in: 4508 m at Homocea, 5783 m at Bereşti and 5790 m at Mândrişca. The resulting compacting coefficients are: 1.4, 1.37, and 1.38.

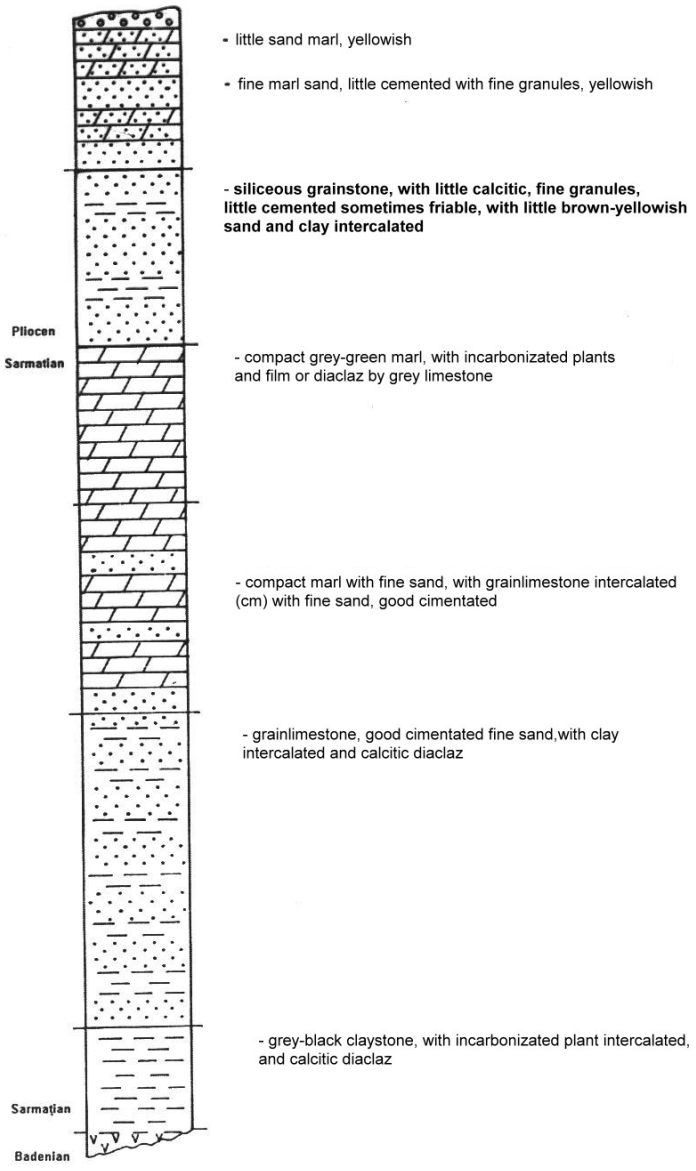

Figure 1. Typical litological column with the foreland basin formations

According to the configuration of the three curves it is obvious that the maximum value of subsidence occurred especially in the inferior and medium Sarmatian (13-11 M. a.) The decrease in amplitude of the subsidence is clear, being marked by the inflexion of the three curves 11M. a. ago during the superior Sarma'ian. If we correlate with the litological column in the maximum subsidence interval, the sedimentation was detritical, respectively black clay and grit stone. The sedimentation rate is high, >500m/M.a.(~1500m/M.a.) in the period when the curves indicate the most intense subsidence and it is characteristic of this type of basin, respectively the foreland foredeep and suddenly decreases to values that correspond to some sedimentation rates of only 10-20 m/M.a., in the superior Sarmatian, when the basin characteristics change.

The decrease in amplitude of the subsidence is given by the inflexion of the two curves from figure 3, produced at the same time, 11 M.a years ago. The two wells with the same value of subsidence are found in front of the interlacing because , the farther we get from it towards the east, to Homocea (figure 1) , the value of subsidence decreases, but the inflexion point that indicates a major change is still 11 M.a.

The high subsidence allowed the accumulation of important sediments rich in organic matter, which, being quickly buried, generated gases deposited in the sandstone layers of the Sarmatian. The organic metamorphosis was analyzed by Baltes, 1987, and for the Sarmatian, in the depth interval 4000-4300 m, the catagenesis stage was reached according to the determined parameters.

In the superior Sarmatian, when the subsidence amplitude decreases significantly, as we can notice from the configuration of the three curves, the litology also changes, the formation becomes marl-like and presents no potential for containing natural gases.

The importance of hydrocarbons accumulations is small even if the subsidence in the foredeep area of the foreland basin was intense and the generation conditions existed. The area extension of the foredeep with great subsidence, superposed to the Jurassic Depression of Barlad is small.

In conclusion, the sedimentation in the East Carpathian foreland basin began in the Kossovian, but it is not present on the whole area. There are wells where the Kossovian formations are missing, Sarmatian formations being deposited over the pre-Neogene relief. During the Kossovian, the subsidence has reduced values, and the formations deposited have small widths.

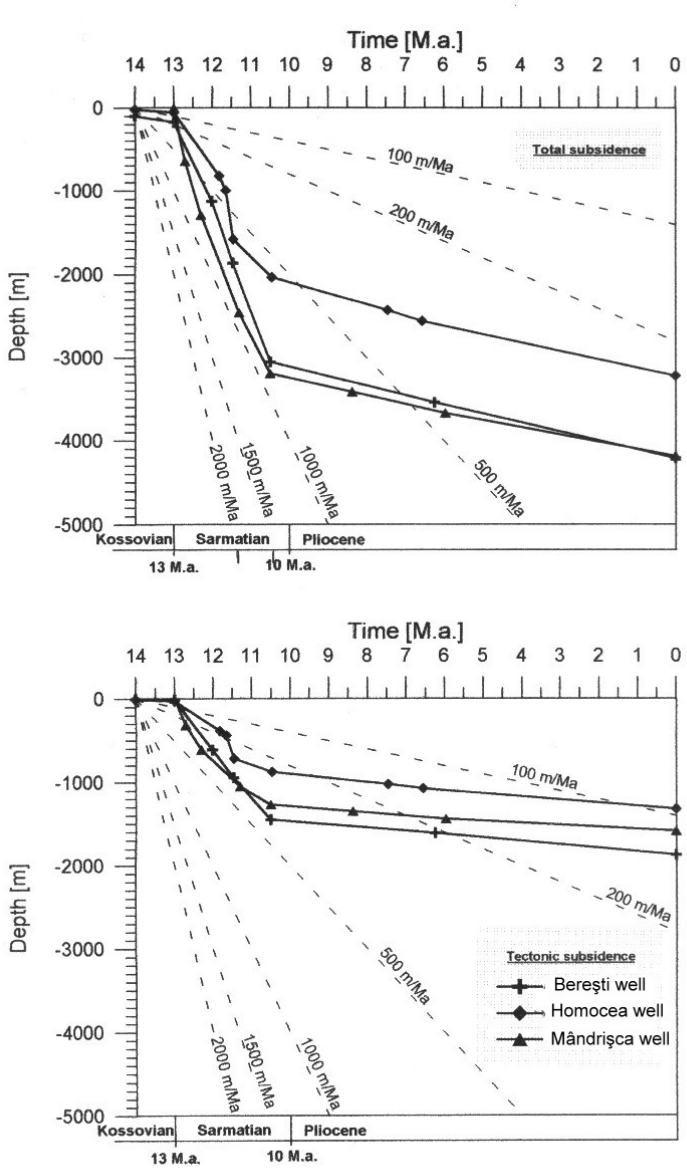

Fig. 3. The total subsidence registered in the wells: Bereşti. Mândrişca, Homocea

The subsidence is important in the inferior and middle Sarmatian when high rates of sedimentation were reached, because 11 M.a ago during in the last part of theBassarabian when the bed load of Carpathian layers over the foreland ended, its value continually decreased in the superior Sarmatian and the Pliocene , until total clogging.

It is important to notice the fact that of the whole foredeep in front of the Carpathians, these high values of subsidence and implicitly the largest widths of deposited sedimentary formations were reached only on this area superjacent to the Bârlad Depression.

The explanation of this fact is that here, the subsidence had two causes: one due to the typical evolution of foreland basin foredeep, and the second was due to the reactivation of old faults that were generated during the Jurassic the Bârlad Depression. This is the only way to explain how the greatest basin depths were reached, only on the area superposed to the old Jurassic Depression.

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