

SEISMIC RESEARCHES ON THE LITTORAL ZONE NEAR THE SIUTGHIOL AND TASAUL LAKES

Sever SPÂNOCHE¹, Gabriel ION²

¹Geological Institute of Romania, Caransebes Str. No.1, 78344, Bucharest, Romania

²National Institute of Marine Geology and Geo-ecology, 23-25 D. Onciul str., 70318, Bucharest, Romania

Abstract. The analysis of the results obtained from the seismic researches along the littoral between Constanta and Năvodari, passing through Mamaia resort highlights the presence of some characteristic seismic levels, represented by massive Jurassic limestones and Green Schists, covered by sandy formations with a thickness of less than 40 m. The Green Schists have been located at depth of about 100 m and in a somewhat lower position in the north of Mamaia resort (140 m).

Key words: Mamaia, Siutghiol and Tasaul lakes, littoral bar, seismic profiles

INTRODUCTION

The paper shows the results of the seismic research carried out along the Mamaia littoral bar and northwards up to Năvodari.

These results will be analysed and compared with the previous data obtained from Palazu Mare area.

As it is well-known the Mamaia littoral bar, having a length in between 7-8 Km, starting South of Mamaia resort and going North as far as Mamaia Village, separates the Siutghiol Lake in the W from the Black Sea waters, in E through a mostly sandy area of about 400 m in width resting over formations of continental origin (Fig.1). The

total thickness of these little consolidated deposits reaches maximum values of more than 70 m in the Bucuresti Hotel area; the maximum thickness is located in the extreme south of the littoral belt.

The deposits presented here were intercepted by shallow drillings and consist mainly of beach sands, with clay intercalations, small intercalations of shell banks or gravel. The beach sands have a medium thickness of 2 m. They rest on the clay deposits extending on the bottom of Siutghiol lake. Westwards, on the banks of the lake, the Quaternary deposits consist of loess being about 20 m thick; a level of clay-gypsum (terra-rosa) formations of about 2-3 m in thickness lies on its base.

Older formations outcrop there - Sarmatian organogenic limestones. There are also Senonian chalky limestones as well as Barremian limestone banks. Under the Cretaceous formations there are massive Jurassic limestones intercepted by the drillings from Palazu Mare at a depth of 60-80 m and which continue up to the level - 500 m.

North of the Siutghiol lake are even older formations represented by Green Schists which continue southwards up to Capidava-Ovidiu Fault, then being intercepted at very big depths under 1.000 m in Palazu Mare area.

1. "Pescarie" profile, located on the beach NE of the Tăbăcărie lake has highlighted the following succesion of seismic levels:

- 3 meters of unconsolidated sand, where the speed of the seismic waves exceed the value 300 m/s;

- under this level there is a 7-8 m thick layer in which the speed is of about 1.000 m/s, certainly still Quaternary formations.

These might represent the continuation to the east of the loess deposits level from Palazu Mare where the speed does not exceed 1.200 m/s;

- at the base of this level, at a depth of 11 m, there is a seismic level with the speed of 2.000

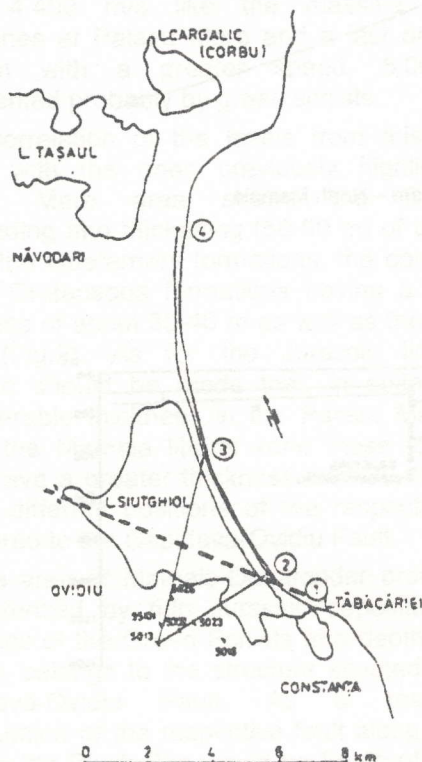


Fig. 1 Seismic profiles location (1-4, seismic profiles; 5013, Drilling; double dashed line, Capidava Ovidiu Fault)

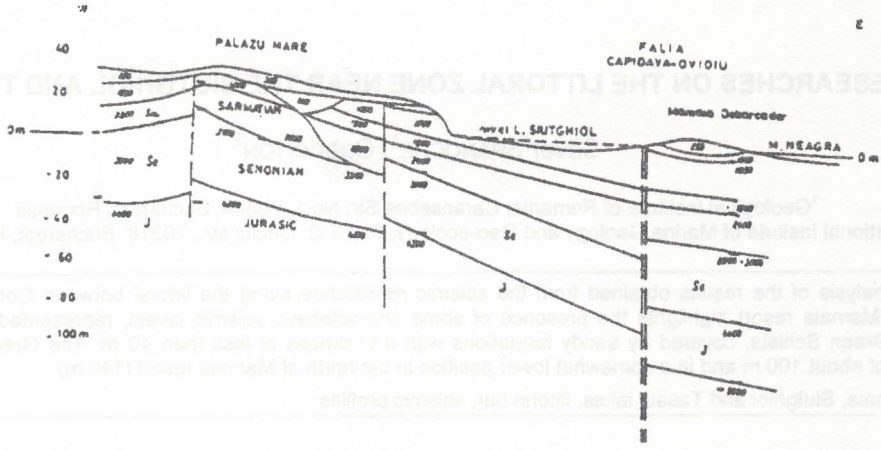


Fig. 2 Geological interpretation of a seismic cross section between Palazu Mare – Mamaia (Debarcader)

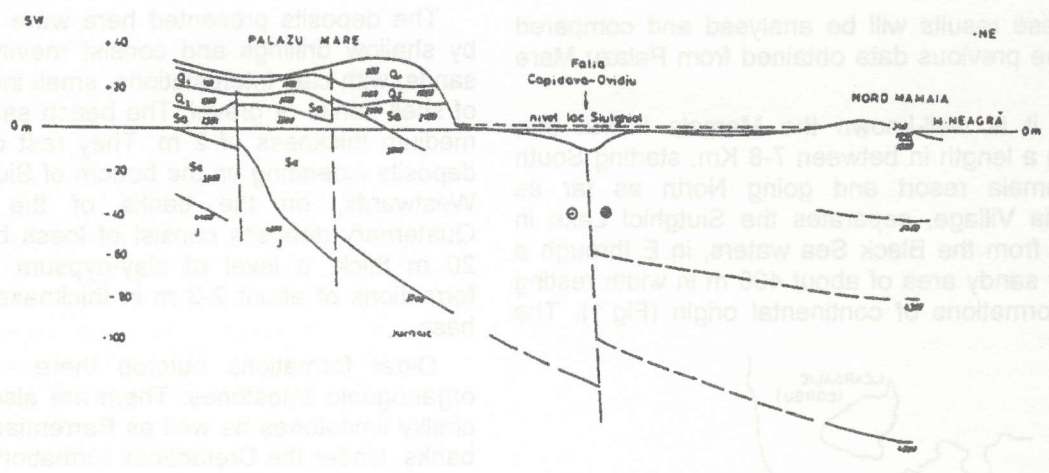


Fig. 3 Seismic section between Palazu Mare – North Mamaia

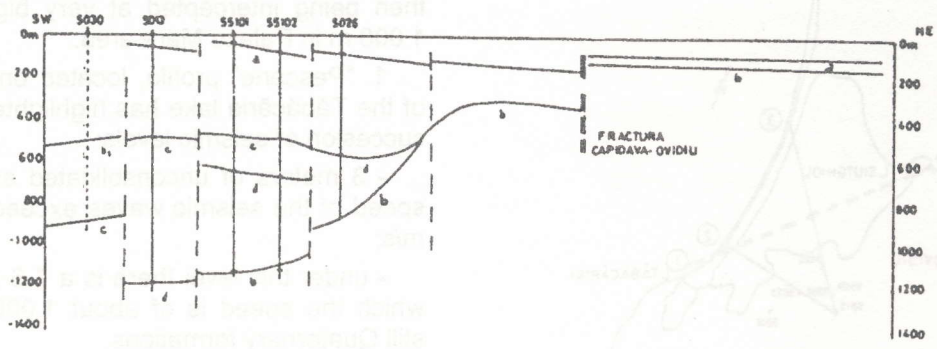


Fig. 4 Deep section between Palazu Mare – North Mamaia (a = Jurassic; b, b₁ = Green Schists; c = Crystalline Schists; d = gneisses)

m/s, probably the clay level the Quaternary begins with. It might represent Sarmatian organogenic limestones which continue from Palazu Mare (where they are 6-16 m thick and have a speed of about 2.100 m/s) to Constanta.

2. Mamaia Debarcader profile was carried out near Mamaia beach correlated with a drilling (Aurora Hotel) about 30 m deep which crossed mainly sands and clays.

From the seismics point of view the researched area consists of 2-3 m of loose deposits with $V=250$ m/s, a thin layer (2 m) with $V=1.100$ m/s then a sandy level, 18 m thick, where $V=1.600$ m/s; the area continues with the level characterized by $V=1.800$ m/s, then following a remarkable speed contrast from 1.800 to 2.400 m/s. This level might well correlate with the clay formations at the base of the Quaternary deposits in the Palazu Mare area. As a result, both this level and the one immediately above it (of 1.800 m/s) may be considered as continental formations continuing under the waters of Siutghiol lake.

Mentioning that the Sarmatian formations (with $V=2.000-2.200$ m/s) are present here, their spreading area stopping somewhere to the West, three deeper seismic levels have also been highlighted. One at a depth of 50 m, with $V=2.700-3.000$ m/s, possibly Cretaceous organogenic limestones, another one at the level - 80 m, characterized by the speed of the seismic waves of about 4.400 m/s like the massive Jurassic limestones at Palazu Mare and a last one under 100 m with a greater speed, 5.000 m/s, represented probably by green schists.

A correlation of the levels from this seismic profile with the ones previously highlighted in Palazu Mare area shows the Eastwards descending and thickening (50-60 m) of the levels within the Quaternary formations, the continuation of the Cretaceous formations having a constant thickness of about 30-40 m as well as the Jurassic ones (Fig.2). As for the Jurassic limestones mention should be made that, in spite of their considerable thickness in the Palazu Mare area, under the Mamaia littoral zone these formations don't have a greater thickness than 30-40 m, due to the different positions of the respective fields compared to the Capidava-Ovidiu Fault.

The area of Mamaia-Debarcader profile being characterized by thin Jurassic deposits, by the presence of the Green Schists at a depth of about 110 m, belongs to the structure situated North of Capidava-Ovidiu Fault. As a result, the continuation of the respective fault along Siutghiol lake, to the Black Sea would be South of Mamaia-Debarcader namely up to Profile 1 "Pescărie".

3. Mamaia North Profile, located on the beach, in the extreme Northern part of the resort has

highlighted the same seismic levels shown in the section of profile 2. From the seismics point of view, the layers have a similar thickness and quite close propagation speeds of the elastic waves, being thus able to admit that the Jurassic limestones have a small thickness, about 55 m, the Green Schists being lower, at 142 m.

The correlation of the results obtained in the Palazu Mare area with the ones from profile 3 can be studied in a deep seismic section (Fig.3), oriented NE-SW, crossing the Siutghiol lake.

Out of this section we can highlight levels representing the Quaternary made up of several layers, having speeds of 260 m/s, 700 m/s, 1.100 m/s, the Sarmatian (quite thin) with speeds of 2.100-2.200 m/s, Cretaceous limestones (speed = 3.200-3.500 m/s), highlighted locally in Palazu Mare area, massive Jurassic limestones (speed = 4.400 m/s) that go deeper to NE up to the Capidava-Ovidiu Fault, where they are at a depth of 120 m; northward of the respective fault the limestones are intercepted at a depth of 60 m lowering slightly to the Black Sea. At a depth of 140 m the Green Schists level was highlighted.

In the Palazu Mare area the levels representing the Sarmatian, Cretaceous and Jurassic are interrupted by different faults. These continue even deeper (Fig.4), affecting bottom formations too as we can see in a geological cross-section made using the drilling data within the area and the seismic research results (Spânoche, 1979).

The section shown in Figure 4 which follows the route of Profile 3, Palazu - Mamaia Nord, formerly discussed, highlights some unique structural characteristics.

We show for the first time the geological situation near the Capidava-Ovidiu Fault, at levels below the Jurassic surface. Thus, the Green Schists characteristic for Central Dobrogea which have been highlighted in Mamaia area at 110-140 m depth, fall 150-200 m in the area of the fault then, SW, permanently descend to a depth of 800 m at the drilling 5026 and further on to the 1.150 m limit. The gneiss, the oldest formations within the region, in the 5026 drilling are at a depth of about 550 m, then, in the central part are lowered down about 200 m, supporting younger crystalline formations. In the south western part of the section the gneiss complex lowers down, reaching the depth of 1.200 m following then another sudden lowering together with the crystalline schists, the last ones being located at level 900 m and supporting green schists of Cocosu type (b1).

It emerges from the presented data that the Capidava-Ovidiu Fault is of a lesser importance, as it affects only the sedimentary deposits (the Central Dobrogea Green Schists were found South of the respective fault, even if at greater depths).

Therefore we should admit the presence of a major crustal fault separating Southern from Central Dobrogea somewhere South of the Palazu Mare iron ore. Such a fault with a crustal character has already been highlighted north of Medgidia (Dealul Agi Cabul), on a seismic profile through the centre of Dobrogea, crossing it from N to S between Casimcea and Negru Vodă.

4. Năvodari Profile, located on the beach between Năvodari and Capul Midia, south of the Tasaul and Corbu lakes, presents seismo-geological conditions similar to those met at Mamaia. Jurassic limestones outcrop within the area on the northern shore of Tasaul Lake, on the shores and on the bottom of Corbu Lake, as well as older formations - Green Schists - on the southern shore of the Tasaul Lake, north of Corbu lake respectively.

Within the area, the seismically investigated

At about 70 m the seismic section shows the presence of a level represented by very consolidated rocks, the speed of the seismic waves being of about 4.400 m/s.

Under this seismic level, at the depth of 110 m, more compact formations appear, with speeds of about 5.000 m/s representing probably the Green Schists. Considering this, the seismic level with a speed of 4.400 m/s may be looked upon as representing massive limestone formations of the Jurassic in the Casimcea-Midia synclinal.

The analysis of the results obtained from the seismic researches along the littoral between Constanta and Năvodari, passing through Mamaia resort (Fig.5) highlights the presence of some characteristic seismic levels, represented by massive Jurassic limestones and Green Schists, covered by sandy formations with a thickness of less than 40 m.

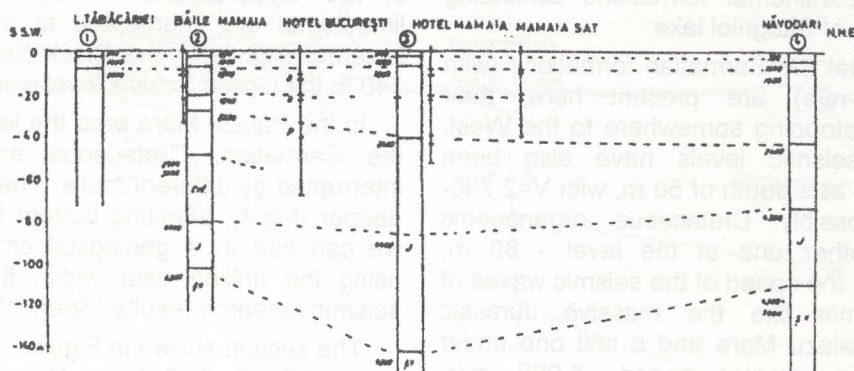


Fig. 5 Seismic section in the Black Sea littoral zone between Constanta - Mamaia - Năvodari (1-4 = seismic results; ↑ = data from drillings)

Green Schists and the Jurassic formations are covered by sands which form the barrier separating the sea from the western lakes.

This complex of sandy formations has a thickness of more than 40 m consisting of 3 m of loose sands (speed = 300 m/s), some other 3 m of sands with speed of 1.000 m/s, after which a wet, sandy formation follows, the presence of the water thus increasing the speed of the seismic waves up to 1.600 m/s.

At the level of 42 m a more compact seismic level was highlighted, characterized by the speed 2.400 m/s, probably the clay formation at the base of the Quaternary deposits.

Between the Jurassic limestones located by measurements at the level 75-80 m depth and the sands from the upper part of the seismic section is a level characterized by a speed of about 2.400 m/s, representing quite consolidated formations, situated near the base of the Quaternary.

The Green Schists have been located at depth of about 100 m and in a somewhat lower position in the north of Mamaia resort (140 m).

The Cretaceous formations rarely appear and they have been pointed out only in the Mamaia-Debarcader area characterized by speeds of 2.700 - 3.000 m/s.