Forum geografic. Studii şi cercetări de geografie şi protecţa mediului
Year 9, No. 9/2010, pp. 5-8

THE ANCIENT CITY OF CALLATIS AND THE NEOTECTONIC MOVEMENTS

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Abstract

Southeastwards of Mangalia, 6 - 7 meters under the sea level, on a surface of about two hectares, there were discovered vestiges of the ancient fortress of Callatis. The settlement known since the 4th century B.C. had almost a millenary existence, but it is not known when it ceased to exist and what causes triggered it. Different suppositions were made and, among them, the telluric causes are plausible. The Southern Dobroudja Platform is penetrated by mobile faults and the compartment of Mangalia is affected by a negative neotectonic movement that gets accentuated towards southeast, where the epicentres of earthquakes with repeated manifestation have been observed. The negative movement rate is 3 - 4 mm/year and, cumulated during the 15 centuries that passed since the disappearance of the city of Callatis, it could explain the depth at which the vestiges of the settlement are presently located.

Keywords: *Dobrudja Tableland, submerged vestiges, neotectonic movements, earthquakes, sedimentation cycles, fault network*

Rezumat

Vechiul oraş Callatis şi mişcările neotectonice. La sud-est de Mangalia, sub nivelul mării, la o adâncime de 6 - 7 m, pe o suprafaţă de aproximativ 2 ha, au fost descoperite vestigii ale cetăţii antice Callatis. Cunoscută din secolul al IV-lea î.e.n., a avut o existenţă de aproape un mileniu, dar nu se ştie când anume şi-a încetat existenţa şi mai ales din ce cauze. S-au făcut diferite presupuneri şi, dintre acestea, cauzele telurice sunt cele plauzibile. Platforma Dobrogei de Sud este străpunsă de falii mobile, iar compartimentul Mangaliei este afectat de o mişcare neotectonică negativă care se accentuează spre sud-est, acolo unde s-au constatat epicentrele unor seisme cu manifestări repetate. Rata mişcărilor negative de 3 - 4 mm/an, cumulată timp de 15 secole de la dispariţia oraşului Callatis, ar putea explica adâncimea la care se află în prezent vestigiile oraşului.

Cuvinte-cheie: *Podisul Dobrogei, vestigii submerse, miscari neotectonice, seisme, cicluri de sedimentare, retea de falii*

SUBMERGED VESTIGES

By the middle of the year 2009, in the daily press there appeared 2 - 3 articles of the type of those destined for curiosities and somewhat sensational, concerning the presence of the vestiges of the antique Callatis fortress at 6 or 7 meters under the sea water level. After brief investigations, a team of autonomous divers, eager of submerged archaeological research, assessed that numerous remains of the renowned disappeared settlement are to be found on a surface of about two hectares, in the sand and ooze on the bottom of the sea. The fact is extremely inciting for those who wish to investigate the unknown, but also for any person who knows about the temporarily prosperous settlement that existed more that 20 centuries ago, the present location of its vestiges being under the sea water.

There is no doubt that when such a discovery is made many questions arise and numerous hypotheses may appear, some of them even being the product of a rich fantasy, but still, the phenomenon must have a correct, verifiable explanation. The archaeological remains of Callatis fortress certify its existence from the 4th century B.C., but there are certain references that appear in written documents dated two centuries before. We are more interested in the moment of the disappearance of the fortress than in that of its foundation by the Greeks, on the place of a Getae settlement.

During its about one millennium long existence, the fortress had prosperity and decline periods, being known the fact that the decay registered at the beginning of our era was followed by a flourishing period, which probably lasted for a few centuries. The exact duration, as well as the moment and precise causes of the disappearance of the fortress are not known. Different suppositions have been made in connection with this phenomenon, the most plausible causes being the telluric ones, especially since the vestiges of the fortress are under the sea water.

One of the hypotheses argues that the disappearance was provoked by a strong earthquake that led to the submersion of an important part of the settlement. Another one pleads for the progression of the sea (an ingression), which would

have destroyed the settlement through inundation and the action of the waves (abrasion). Without taking into account other probable social-economic and historic causes that would have led to the desertion of the settlement, the main cause is still the one related to natural phenomena of tectonic nature, the one that changed the relations between sea and land in a relatively short period.

The tectonic signals have always been noticeable, even in 2009, when a shallow depth earthquake, having the epicentre at approximately 15 kilometres distance of Mangalia town, shook the region. Although the earthquake registered only 5.1 degrees on the Richter scale, it was felt on a large area and it did not cause prejudices. Nevertheless, there occurred other more severe earthquakes, with important effects on the seaside and on Dobroudja region, firstly affecting the settlements. Among these events, it is important to mention the earthquake that took place on March 31st, 1901, when there were registered 7.2 degrees on the Richter scale; the earthquake occurred at a depth of 15 kilometres in the Black Sea, had the epicentre eastwards of the Caliacra Cape and it led to the formation of a tsunami wave that flooded the settlement of Mangalia and important seashore surfaces.

STRUCTURE OF THE REGION

From the structural viewpoint, the region belongs to the South-Dobroudja Platform (Eoproterozoic unit), being bordered northwards by the main (crustal) fault Palazu (Capidava - Ovidiu). Towards south and south-west, it is limited by Fierbinţi fault, which crosses the entire Moesic domain. From the morphological point of view, it represents the entire Southern Dobroudja Tableland, in the southeastern part of which there is located the Mangalia Tableland.This unit is made of old formations and its base, constituted of granitic gneiss and mesometamorphic crystalline schists (Palazu crystalline), deepens southwards. The above sedimentary formations accumulated during several sedimentary cycles, very probably starting with the Lower Paleozoic (Vendian - Cambrian), the presence of which was registered in the drills realized at Palazu Mare, Cumpăna, and around Mangalia (V. Mutihac et al, 2004, p. 30). The next cycle, taking place from the Middle Jurassic to the Cretaceous, mainly marked the deposition of the carbonaceous rocks.

The Jurassic deposits do not crop out, while the Cretaceous ones are open in the valleys from the western part of the Tableland, which are directed towards the Danube, and especially along the Carasu Valley. When the Danube - the Black Sea Canal was dug along the Carasu Valley, the formations of the Cretaceous cycle got to be known in detail and they prove that in the second half of the Cretaceous the region underwent certain tipping movements that led to the appearance of sedimentation discontinuities.

The following sedimentation cycle - the Paleogene one - led to the accumulation of predominantly calcareous (Eocene) and disodilic bituminous (Oligocene) formations, which are preserved on limited surfaces. After a stratigraphic gap up to the Badenian, there followed the last sedimentation cycle, the Mio-Pliocene one, which started with sandy Badenian depositions that only appear discontinuously. They are discordantly covered by Sarmatian organogenic limestones, giving the general characteristic of the Southern Dobroudja Tableland. They appear in all valleys directed towards the Danube, but also on the seaside, in the sector located southwards of Eforie. This last sedimentation cycle ends with the deposition of certain clayey Pliocene sands that are present at the surface of the tableland only towards the Danube.

The entire ensemble of rocks appeared during the last sedimentation cycles is covered by a relatively thick layer made up of loess and loessial deposits, hiding the character induced by the Sarmatian calcareous formations.

A geological cross-section with general south - north direction along the seaside, going from the border to north of Palazu, points out a structure that is pierced by numerous faults, the compartments located north of Mangalia showing a lowering tendency towards south and southeast. Besides the old Paleozoic and Mesozoic formations, the faults also influence the Paleogene and Miocene sedimentary layer. Although this layer is less affected in vertical plan than the older formations, its compartments are involved in the same general lowering movement towards southeast, which corresponds to the general direction of the faults (Fig. 1).

TECTONIC MOBILITY

During its very long evolution and on its structural completion in the time of the last sedimentation cycle and after it, the Southern Dobroudja Tableland underwent certain tipping movements and, at the same time, a breaking process determined by a network of faults that cross this structural edifice on its entire depth, touching all formations, from the Proterozoic fundament to the Mio-Pliocene layers.

The faults - especially the main ones and those that structurally delimitate the Southern Dobroudja Tableland - will always be reactivated, defining this tableland as a horst, in relation with the neighbouring units from the north towards the south. Another important element is that the faults within this unit

delimitate compartments that are characterized by different vertical movement tendencies and some of them are very active.

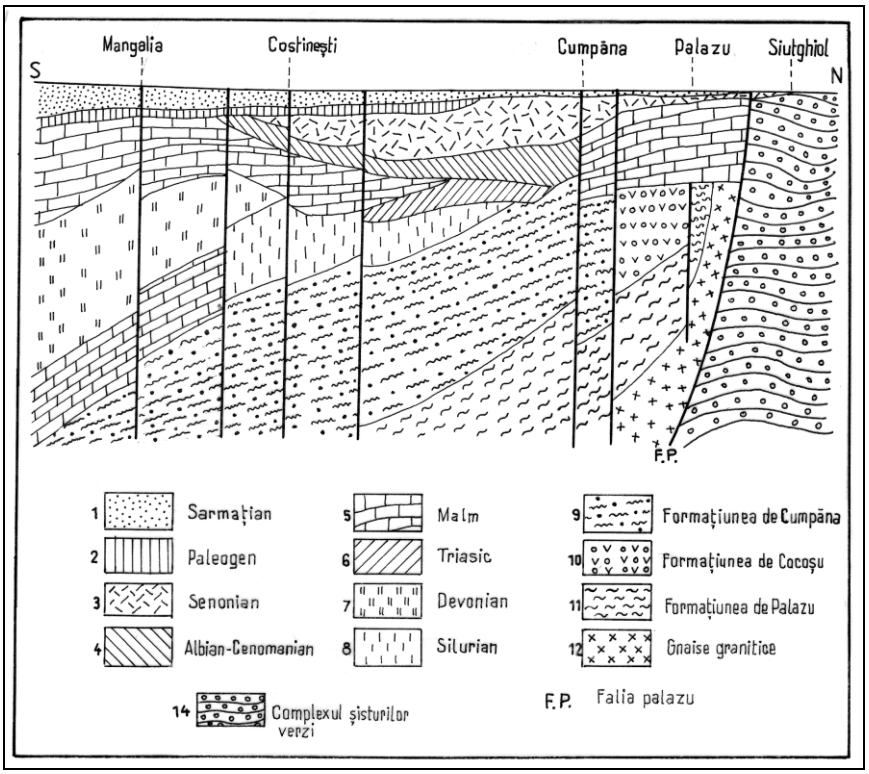

Fig. 1 Geological cross-section along the seaside, between Vama Veche and Siutghiol (after V. Mutihac et al. 2009)

In other words, the Southern Dobroudja Platform is not a rigid structural unit. Besides the main faults that delimitate it, the base plate was affected by secondary faults, the mobility of which is pointed out by the neotectonic movements and by the earthquakes.

North of Mangalia (approximately on the Cobadir - Topraisar - Costineşti alignment) there is located an important fault that delimitate the compartment of Mangalia, bordered southwards by another important, active fault: Sabla - north Caliacra. The earthquakes with the epicentres located southeastwards of Mangalia - such as the one that took place on March 31st 1901 (7.2 degrees – it led to the formation of a big wave that flooded the seashore) and the one that occurred on August 5th 2009 - depend on this fault.

The above-mentioned compartment descends towards southeast and it is permanently affected by present movements that are not uniform from viewpoints of sense or intensity.

On the Map of the Recent Vertical Crustal Movements (work of M. Visarion, M. Săndulescu, I. Drăgoescu, M. Drăghici, I. Cornea, M. Popescu, printed at the Institute of Geology and Geophysics, 1977), the western and southwestern parts of the Southern Dobroudja Tableland are shown as an area caught in a positive movement of more than 1.5 mm/year. As we approach the seaside, the positive movement decreases, then is inverted and the negative character of the movement becomes more and more accentuated up to the shore line.

On the map that is annexed to the article published in 1998 by D. Zugrăvescu et al., in the southeastern sector there is delineated an area in which the negative movements reach 3 - 4 mm/year. This area slightly broadens towards the sea, the town of Mangalia - the place of the ancient fortress Callatis - being located in its central part.

The eastern side of the Dobroudja Tableland is generally affected by a light negative present neotectonic movement, but the research conducted during the last 50 - 60 years underlined the most important subsidence in the area located around Mangalia (Fig. 2). The recurring earthquakes, which register or even surpass 7 degrees, represent the most obvious proof of the instability of the structure crossed by an active fault. To the subsidence movements characterized by intensities of 3 - 4 mm/year during the earthquakes, there were associated plungings (falls) of the soil, which explains clearly enough the alteration and relatively rapid disappearance of the city of Callatis.

Usually, on long term, the intensity of the movements is variable and their value can decrease down to the cessation or even reversal of the movement. On the other hand, on short periods, the

assessment made at a given moment can be considered as such.

The rate of 3 - 4 mm/year, which was recorded by the researches conducted during the last hundred years, can be taken into consideration for the almost 15 centuries past since the disappearance of the city of Callatis under the seawater.

The remains of the fortress are to be found at a depth of 6 - 7 meters, which generally corresponds to the subsidence process characterized by values of 0.3 – 0.4 m/century and confirms the hypothesis of the disappearance of the settlement as a consequence of the neotectonic process that affects the seaside in the Mangalia – Vama Veche sector.

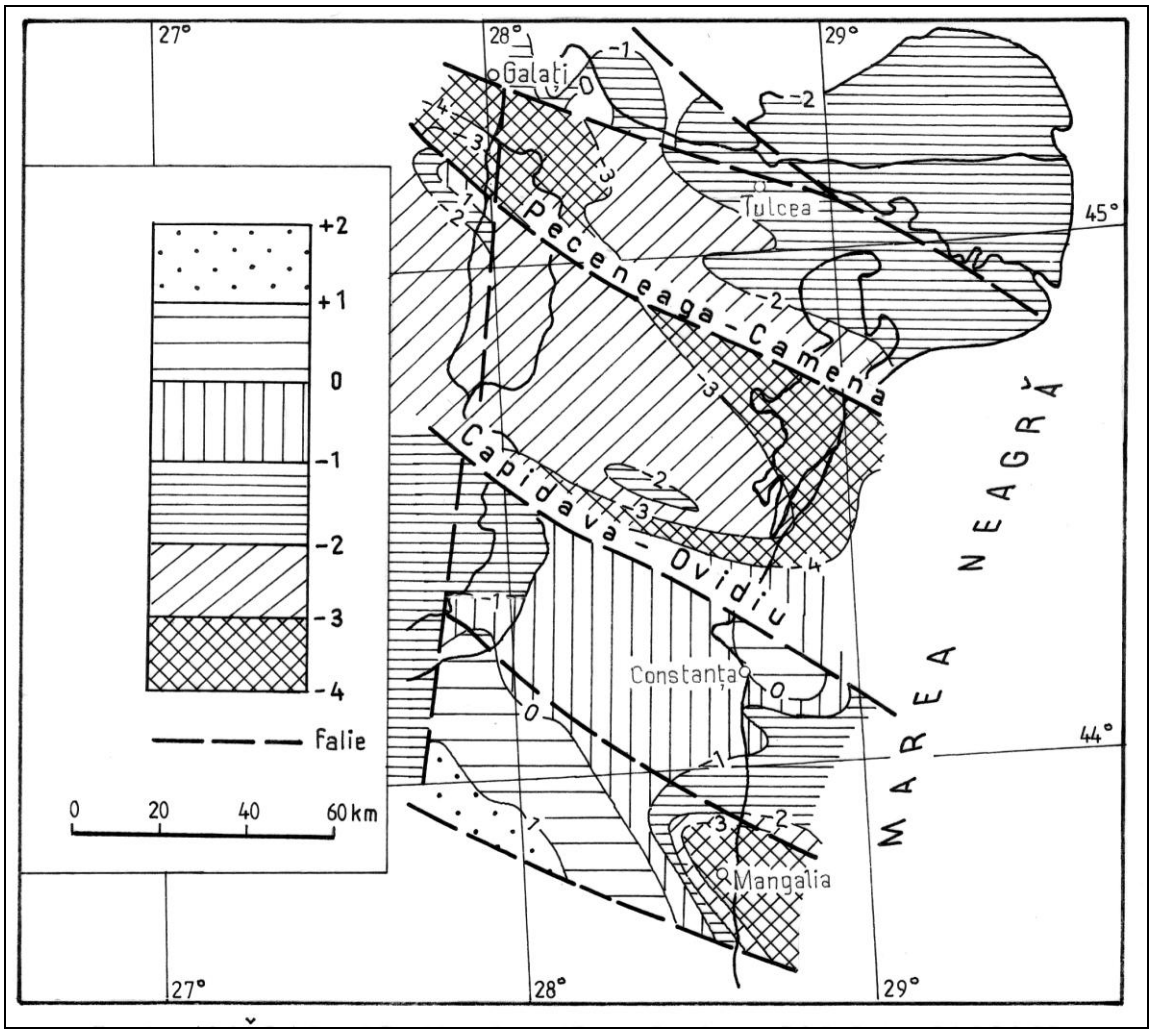

Fig. 2 The present crustal movements within the Dobroudja Tableland (after D. Zugrăvescu et al. 1998)

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