# PRELIMINARY EVALUATION OF THE ABATOR QUARRY – HÂRȘOVA (ROMANIA) – A PROPOSAL FOR A NEW GEOSITE

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**Abstract.** The Abator Quarry from Hârșova (România) is part of the natural exposure of the Baroi Hill on the Danube bank, integrated in the ROSCI0022 "Canaralele Dunării" protected area. The present study represents a scientific reassessment, as well as an analysis of the ecotourism potential of this site. A series of geological and paleontological studies have been carried out in the region, without exactly defining all the areas of scientific but also practical interest. In its outcrops, the Abator Quarry provides numerous fossils of lower Oxfordian age, which are easily accessible, being located in the immediate proximity of the Hârșova town. Some of the fossils have index value, as is the case with the ammonites. Our analysis is focused on the scientific importance of the site and the approach of the sustainable exploitation of the touristic potential.

**Keywords:** paleontological site, Late Jurassic, ammonites, scientific value, ecotourism.

**Rezumat. Evaluare preliminară a Carierei Abator – Hârșova (România) – o propunere de înființare a unui nou geosit.** Cariera Abator din Hârșova (România) este parte din deschiderea naturală a Dealului Baroi din malul Dunării, integrată în aria protejata ROSCI0022, Canaralele Dunării. Studiul de față reprezintă atât o reevaluare științifică, cât și o analiză a potențialului ecoturistic al acestui sit. În regiune s-au realizat o serie de studii geologice și paleontologice, fără a se contura exact toate ariile de interes științific dar și practic. Cariera Abator furnizează numeroase fosile de vârstă Oxfordian inferioară în aflorimentele sale, ușor accesibile – situate în imediata apropiere a orașului Hârșova. Unele dintre fosile au valoare de indice, așa cum este cazul amoniților. Analiza noastră vizează importanța științifică a sitului și modalitatea de abordare a exploatării durabile a potențialului turistic.

**Cuvinte cheie:** sit paleontologic, Jurasic superior, amoniți, valoare științifică, ecoturism.

## INTRODUCTION

From a geographical point of view, Hârșova is located in the north-western part of the Constanța County (Fig. 1), on the right bank of the Danube River just upstream the confluence of the Old Danube with the Borcea branch. In ancient history this was a very strategic point and we have much evidence that state its importance. The Abator Quarry is located in the western part of the Hârșova built-up area; there is also some archaeological reference for this particular point: a crater vase from a *La Tène* grave (NICOLAE, 2010).

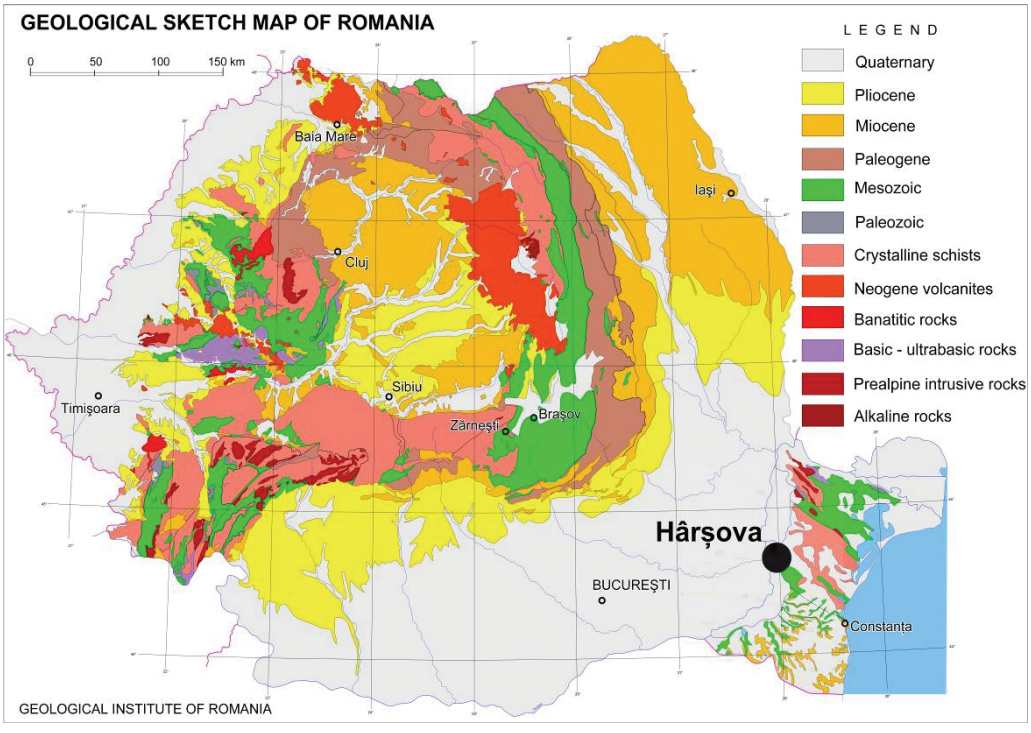


Figure 1. Location of Hârșova, the site area on the Geological map of Romania (simplified by Gheuca Ion after SĂNDULESCU et al., 1978, with annotations).

Going further in time, we discover that Hârșova and its surroundings have geological significance for their impressive fossil variety of the Jurassic deposits (Fig. 2). In the western part of Central Dobrogea, the Hârșova region is considered among the richest fossiliferous sites (BARBU & LAZĂR, 2004), and it is also very accessible to the public.

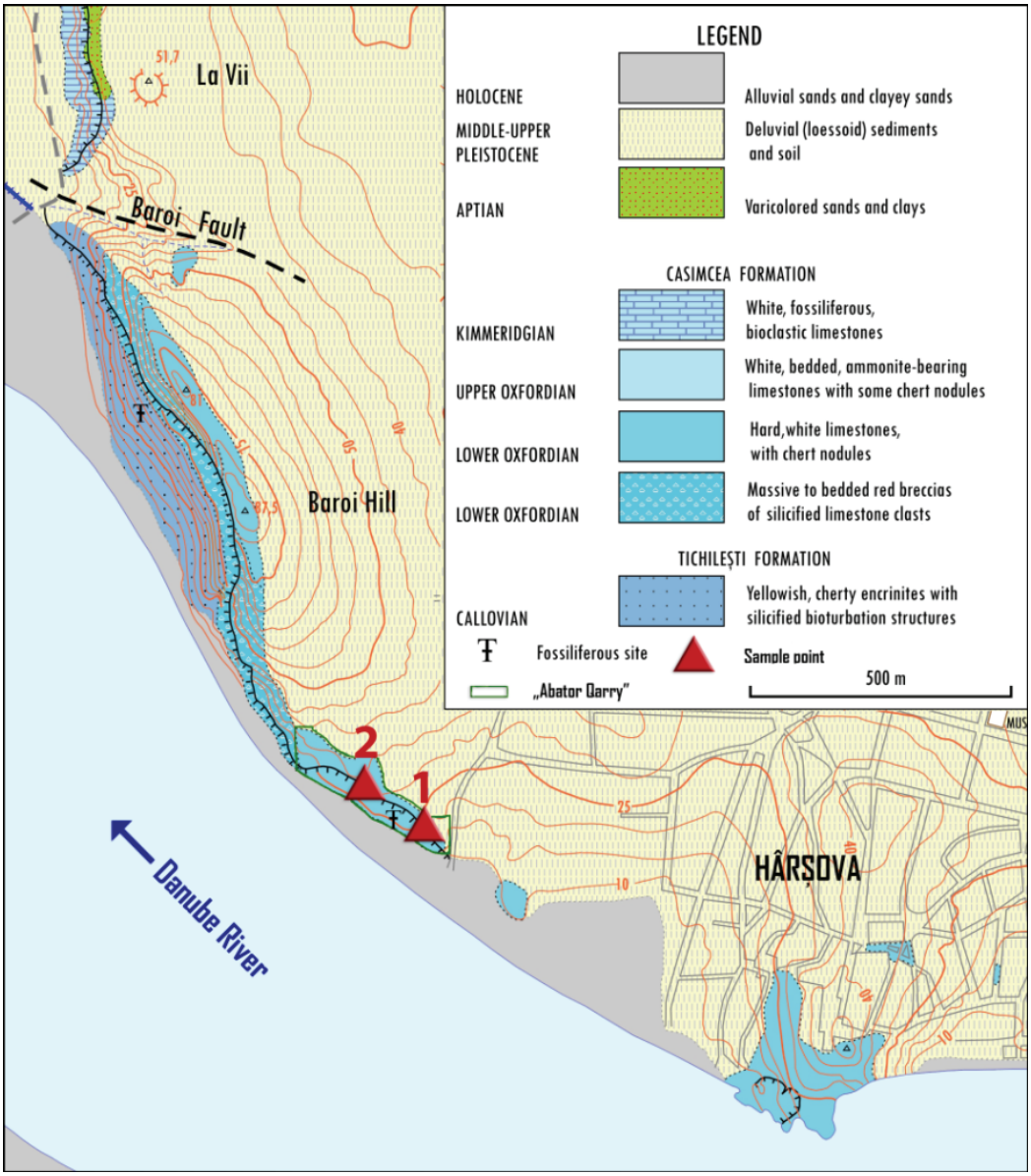


Figure 2. Location map (green outline). 1: rich fossiliferous point (ammonites, brachiopods, sponges); 2: the last fossiliferous occurrence in the considered formation (after BĂRBULESCU, 1974; DRAGASTAN et al., 1998; with annotations).

The Jurassic of Central Dobrogea is divided into three units: Tichileşti Formation (DRĂGĂNESCU & BEAUVAIS, 1985), Upper Bathonian - Lower Callovian, the Gura Dobrogei Formation (DRĂGĂNESCU, 1979), Middle-Upper Callovian and the Casimcea Formation (BĂRBULESCU 1974), Oxfordian-Kimmeridgian. The Jurassic paleontology and stratigraphy are known from many studies in Central Dobrogea (e.g. ANTONESCU, 1929; BĂRBULESCU, 1974; DRĂGĂNESCU, 1976; RONIEWICZ, 1976; DRĂGĂNESCU et al., 1979; SCHWEITZER et al., 2007; NEAGU et al., 2014; SCHWEITZER et al., 2017). Several papers were dedicated to the "Abator Quarry": SIMIONESCU, 1910; BĂRBULESCU, 1974; DRAGASTAN et al., 1998, NEAGU et al. 2019, DUMITRAȘ et al., 2019. There are fewer papers emphasizing the touristic or educational role of the site (e.g. ANIȚĂI 2013; ANDREI et al., 2013).

The studied area is located in the Casimcea Formation (DRĂGĂNESCU, 1976) of Oxfordian-Kimmeridgian age, exposed in the steep cliffs that border the right bank of the Danube. The location is very accessible for tourists, it provides nearby lodging facilities and it can be an important place for in situ geology learning for pupils or students. A good history museum is located nearby – "Carsium", which also hosts an impressive paleontological collection (NEAGU et al., 2014) from the nearby area.

## MATERIAL AND METHODS

In this preliminary reassessment of the paleontological importance of the fossiliferous point "Abator Quarry", over 50 fossils were sampled, cleaned, photographed and identified. Geological samples were also taken in order to establish the petrographic context and for further microfacies analyses.

The sampling was informative, not a systematic one, insisting on some blocks with a higher fossil content in order to highlight their associations according to the litostratigraphic coloumn (Fig. 3). From a geological point of view, the evaluation of the site was based on previous studies and verified with the new stratigraphic, lithological and paleontological observations of the authors, which revealed both scientific and geotouristic importance.

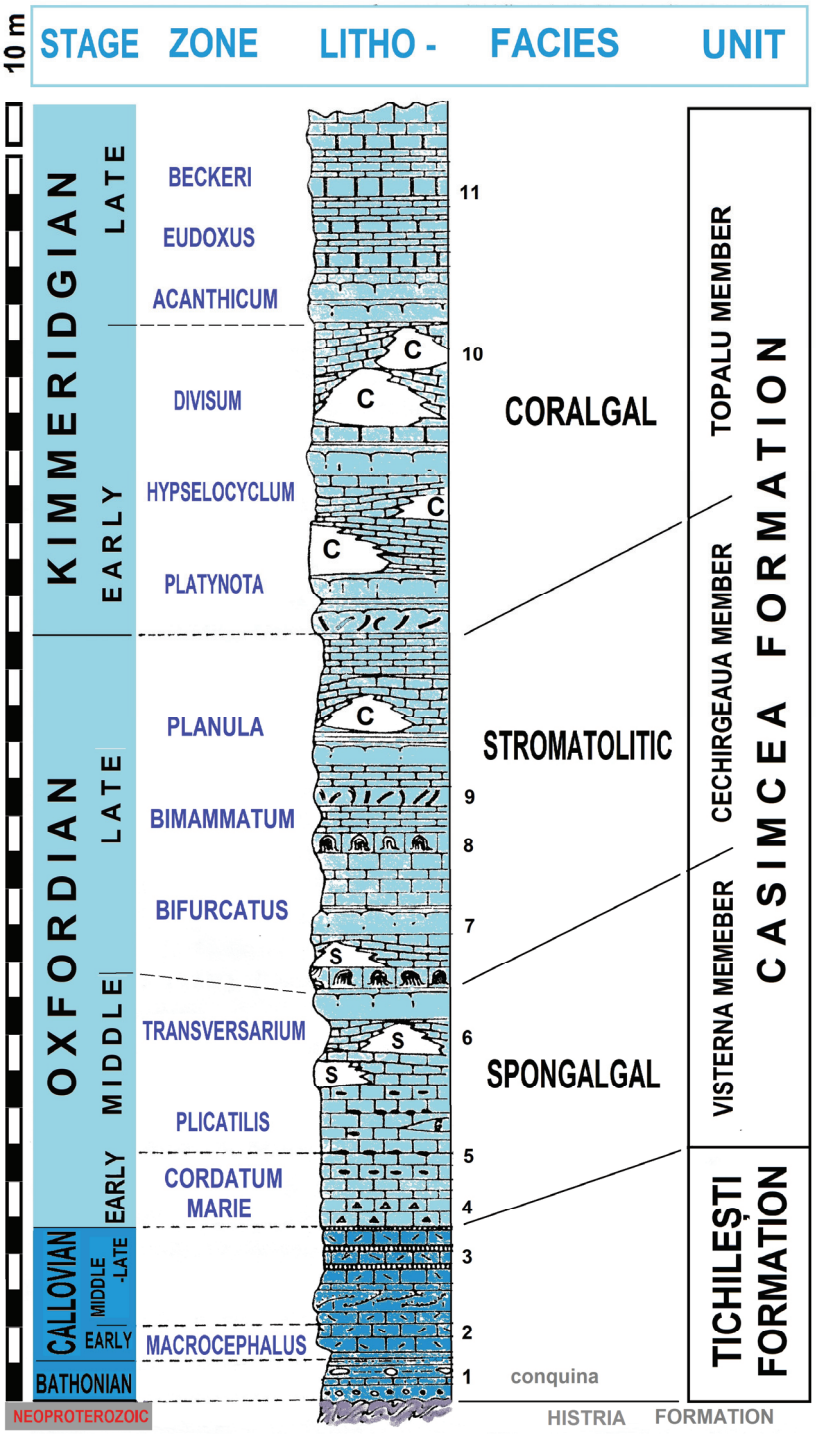


Figure 3. Litostratigraphic coloumn (after BĂRBULESCU, 1974; DRAGASTAN et al., 1998).
Legend: 1 - conglomerate and marls; 2 - sparite limestones and sandstones; 3 - cherts; 4 - breccias; 5 - limestones with cherts; 6 - spongalgal biohermes; 7 - biostrome; 8 - stromatolitic limestone; 9 - limestone with burrows; 10 - coral biohermes and biostromes; 11 - dolomites.

## DESCRIPTION OF FAUNA AND FACIES

Eight facies types were separated in the Casimcea Formation (DRĂGĂNESCU, 1976), reflecting different embers. Out of them, five lithologies can be identified in the Late Jurassic (Oxfordian – Early Kimmeridgian) of the Hârșova region: cherty limestones, biostromal, biohermal and micritic limestones, as well as dolomites (GRIGORE et al., 2013). They are opened in the steep cliffs bordering the right bank of the Danube - Figs. 4a-b.


Figure 4. The outcrops from the Abator Quarry (people as scale): a. View from the Est-South-Est; b. View from the West (photos by Monica Macovei).

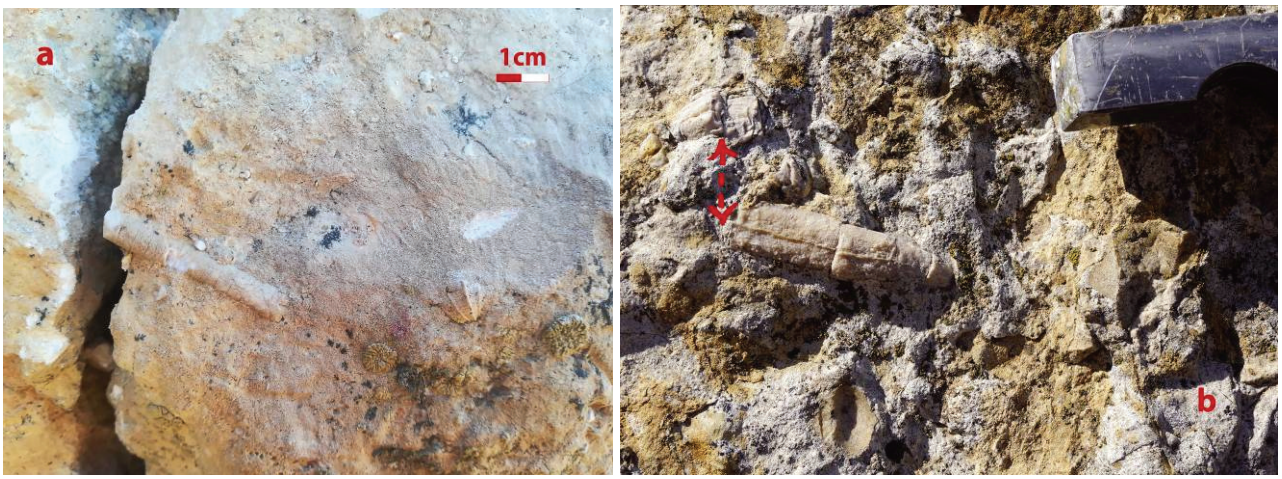


Figure 5. In situ fossils from the Abator Qarry: a. From sampling point 1 (Fig. 2): crinoid columnal fragment beside a brahiopod in calcareus limestone; b. From sampling point 2 (Fig. 2): fragmented belemnite (the local stress can be estimated due to fragmentation and even a detachment by a microfault) and bivalves (geological hammer at right as scale) (photos by Monica Macovei).

In the Abator Quarry, SIMIONESCU (1910) identified a fauna with *Parawedekindia arduennensis* (d'Orbigny), confirming the Lower Oxfordian age, as well as *Phylloceras* aff. *mediterraneum* Neumayr, *Perisphinctes carsiensis* Simionescu, *Perisphinctes claromontanus* Bukowski (probably *Prososphinctes*) and *Perisphinctes* sp., corresponding to the Middle and Upper Oxfordian. The presence of the Upper part of Oxfordian is problematic in such a thin outcrop (under 20 m stratigraphic opening).

In the Abator Quarry area we identified three main types of facies: 1 - a spongalgal facies with numerous fossils (ammonites, brachiopods, sponges, bivalves – see point 1 in Fig. 2) which is quite close in structure to a bioherm; 2 - an overlapping facies with more dispersed fossils, with crinoid columnals (Fig. 5a) – *Millericrinus sp*. and rare bivalves – identified *Chlamys sp.* (juvenile) and brachiopods (point 1 – Fig. 1 and Fig. 4a); 3 - a facies with siliceous accidents, developed 150 meters downstream with brachiopods, bivalves and belemnites - from sampling point 2 (Fig. 2) ilustrated in Fig. 5b – *Hibolites sp.*.

From the rich fauna of the first facies there have been identified: brachiopods (Fig. 6) – *Dorsoplicathyris* cf. *petersi* (Bărbulescu & Grădinaru), *Juralina* sp., *Septaliphoria* cf. *moravica* (Uhlig), sponges (Fig. 7) – *Hyalotragos cf. patella* (Goldfus), *Hyalotragos sp., Cribrospongia sp.,* ammonites (Fig. 8) – *Sowerbyceras* cf. *tortisulcatum* (d'Orbigny), *Ochetoceras* cf. *canalliculatus* (v. Buch), *Taramelliceras* sp. and more Perisphinctidae (as *Parawedekindia arduennensis* (d'Orbigny) Some problems in separating the facies types are due to the fact that many of the fossils are in loose boulders and even in the gravel. They could be considered of stratigraphic value only if associated with the specific lithology (if they still have attached the host material); this can be of interest in using them for teaching activities that can be easily carried out in the quarry.

The analysis of a block located at the base of the outcrop in the sampling point 1 (Fig. 2) revealed the presence, alongside species characteristic for the Lower Oxfordian [such as *Parawedekindia arduennensis* (d'Orbigny) – Fig. 8 – upper-left corner], of some species from the Middle Oxfordian [*Ochetoceras* cf. *canaliculatus* (v. Buch) – Fig. 8 – lower left corner] and others [Oppeliidae, Phylloceratidae – *Sowerbyceras* cf. *tortisulcatum* (d'Orbigny) and Perisphinctidae]. This apparent "mixture" can be attributed to "neptunian dikes" demonstrated with the principle of actualism (SMART et al., 1988) and described in many other regions of Europe: Spain (VERA et al., 1988), Poland (LUCZYNSKI, 2001), Italy (WENDT, 2017), Ukraine (JASIONOWSKI et al., 2012) at the Oxfordian carbonate platform. This emphasizes again the scientific importance of the site and its uniqueness in this territory.

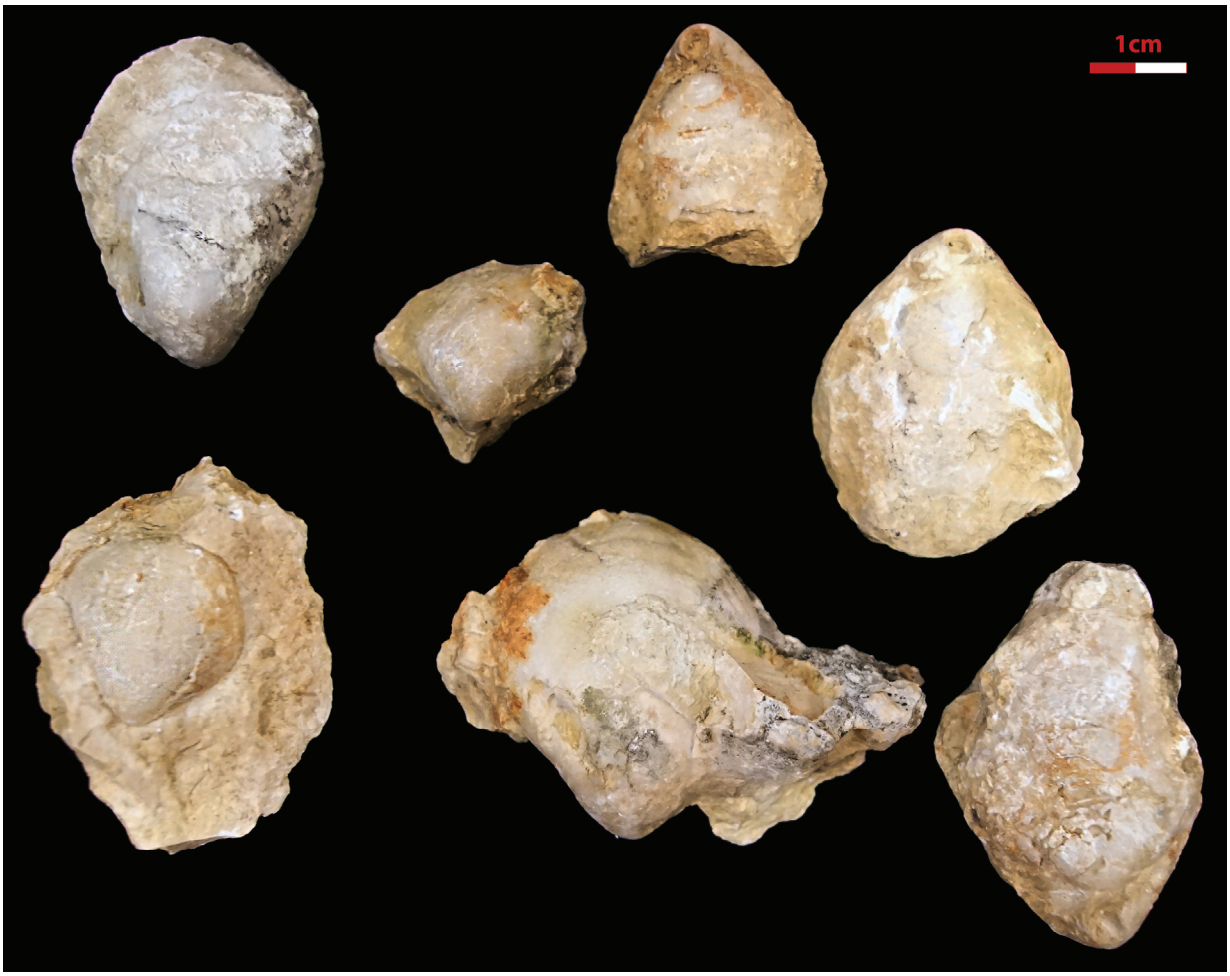


Figure 6. Brachiopods from the Abator Quarry (photo by Monica Macovevi).


Figure 7. Sponges from the Abator Quarry (photo by Monica Macovei).


Figure 8. Ammonites from the Abator Quarry (photo by Monica Macovei).

## DISCUSSION AND CONCLUSIONS

The importance of the Danube corridor was recognized on 5 June 2000 by the Governments of Bulgaria, Moldova, Romania and Ukraine through the signature of the "Declaration on cooperation in connection with the establishment of the Lower Danube Green Corridor" and the "Agreement on cooperation in the protected area of the Danube Delta". Another important moment was the inclusion in the Natura 2000 network (ANIȚĂI, 2013; DORONDEL et al., 2016), but more protection measures are needed to prevent the limestone exploitation (there are some traces of former works and an important modern quarry in the vicinity – Celea Lac) or civilian construction over this particular site (delimited in Fig. 2). Some studies proposed to develop touristic facilities nearby (e.g. IONAȘCU, 2016) and without a sustainable development; the outcrops may be destroyed by uninformed people.

From a scientific point of view, the "Abator Quarry" is the only known fossiliferous site in Romania that exposes the Lower Oxfordian, which also shows the characteristic species of ammonites.

The rich fossil content, very important in refining the Jurassic stratigraphy of Central Dobrogea, the impressive landscape, the proximity of historical vestiges, the thermal basin (a future balneary resort) and accessibility recommend the Abator Quarry for inclusion in the list of sites representative for the geological heritage of Romania, according to criteria of WIMBLEDON & SMITH-MEYER (2012). As shown above, the fauna is mainly represented by brachiopods, sponges, and ammonites (Fig. 8) among bivalves, belemnites (Fig. 5b), very easy to spot even for an untrained eye, which makes the site a potential touristic attraction but with the necessity of minimal arrangements (information panel, indicators on the site, warning signs regarding possible accidents or the forbiddance on collecting fossils etc.). This leads to the necessity of implementing sustainable ecotourism in this area, a responsible way of taking account of the paleontological, historical and educational importance of this site.

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