THREE PALEONTOLOGICAL SITES PROPOSAL AS NEW NATIONAL RESERVES IN THE IRON GATES NATIONAL PARK (ROMANIA)

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Abstract. This study deals with the scientific importance of three paleontological sites from the vicinity of the Svinita village and a way of approach the sustainable exploitation of their touristic potential. The three sites are open carbonate deposits that belong to three sedimentary formations, fossiliferous, of Upper Jurassic age - Lower Cretaceous. If the sites, from the Vodiniciki Valley and the one on the national road, to the south of Svinița, were known from previous authors (RĂILEANU, 1959; AVRAM, 1976; GRIGORE, 1998), the third one was recently discovered and analysed (2021). It is easily accessible, being also on the national road, to the north of Svinița and close to the Saraorski Valley.
Keywords: paleontological sites, Svinița, ecotourism.

Rezumat. Trei situri paleontologice propuse ca noi rezervații naționale în Parcul Național Porțile de Fier (România). Acest studiu urmărește importanța științifică a trei situri paleontologice din vecinătatea satului Svinița și o modalitate de abordare pentru exploatarea durabilă a potențialului lor turistic. Cele trei situri deschid depozite carbonatice care aparțin la trei formațiuni sedimentare, fosilifere, de vârstă jurasic superior – cretacic inferioară. Dacă siturile din Valea Vodiniciki și cel de pe șoseaua națională, la sud de Svinița, erau cunoscute de la autorii anteriori (RĂILEANU, 1959; AVRAM, 1976; GRIGORE, 1998), cel de-al treilea a fost descoperit și analizat recent (2021). Acesta este ușor accesibil, aflându-se tot pe șoseaua națională, la nord de Svinița și în apropiere de ogașul Saraorski.

Cuvinte cheie: situri paleontologice, Svinița, ecotourism.

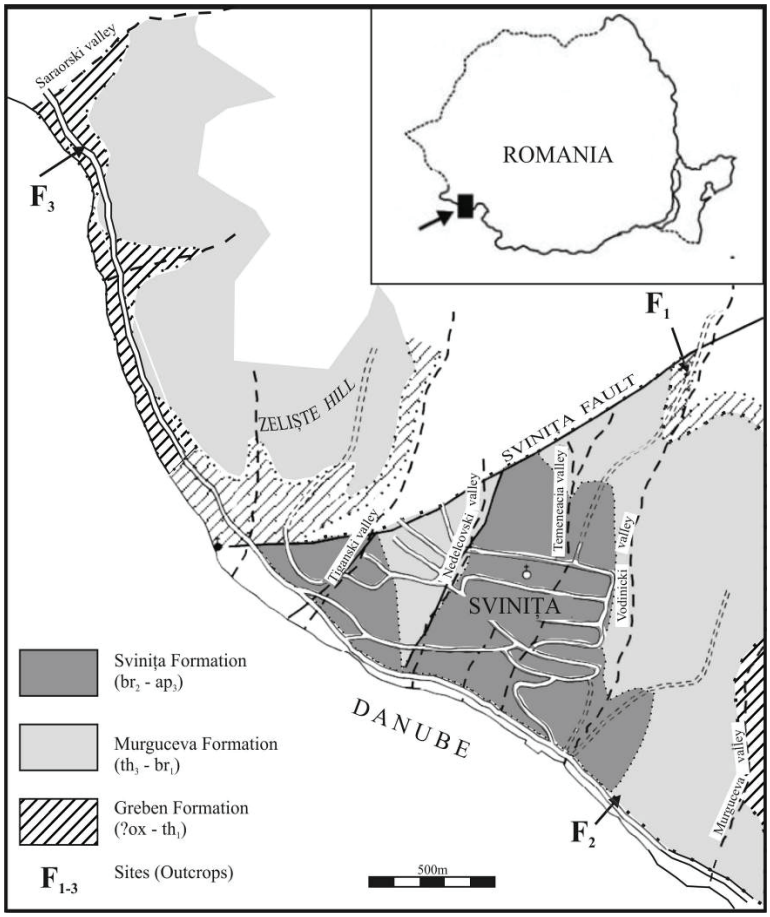

Figure 1. Location of sites presented in the paper on the geological sketch (after AVRAM, 1976).

INTRODUCTION

The paleontological and stratigraphic sites proposed to become reserves in this paper are located near Svinița (Fig. 1). One of them has been proposed by AVRAM (1995) together with several others in the territory of the locality, representative sites for the biostratigraphy of the formations (Murguceva and Svinița) containing the Cretaceous deposits of the region. The other two proposals are for two sites also of stratigraphic and palaeontological value, for the Upper Jurassic deposits of the Greben Formation (POP & GRIGORE, 1997; POP, 1998; GRIGORE, 1998), one of which has been better opened recently when the national road (DN57) was resurfaced. The only site that has become a palaeontological reserve in the region is the one in the Saraorski Valley, west of the village of Svinița (about 2.5 km on the DN57 towards Moldova Nouă). This site has been analywed and promoted by several generations of researchers, starting with those of the Austro-Hungarian Empire time (KUDERNATSCH, 1852; HAUER, 1857, 1869; SIMIONESCU, 1905; KOCH, 1912), continuing with RĂILEANU & PELIN (1960), CODARCEA et al. (1961), BLEAHU et al. (1976) and, recently, with GALACZ (1994), POPA (2003), PANAIOTU et al. (2012), being marked as a reserve since 1980 (DCPJ 18/1980 - BLEAHU, 2019) and reconfirmed by Law 5 /2000 (**No. 2.610**). The "Svinița fossiliferous site" (Fig. 2) keeps a condensed level with ammonites (Bathonian - Lower Callovian) of about 1 m stratigraphic thickness, preserved in oolithic, ferruginous limestone (hardground), as facies of "Klauss" type. This level is part of a limestone suite in sedimentation continuity from the Middle Jurassic to the Lower Cretaceous (Barremian), the "suite" described by RĂILEANU (1960), Sirinia Formation – Saraorski Member (STĂNOIU & GRIGORE, 1997). All

these sites and formations were described and mapped in detail between the ‘50s and the ‘80s on the Svinița 1:50,000 geological map (in work) by NĂSTĂSEANU et al. 1982, later included in the Marginal Dacides Unit (SĂNDULESCU, 1984).

Figure 2. Outcrop of Zelište Formation deposits on the resurgence of Saraorski Valley, on the National Road DN57 (North from Svinița village) – the Indicator Panel of the “Svinița National Reserve” (original).

The three proposed sites are of a great scientific importance, and if they will benefit of a minimal set of measures to reveal their content, they are suitable to be used as a valuable asset for a sustainable form of tourism. They will be a good reason for the touristic development in the area. There are many papers regarding the touristic activity in the surroundings of the Iron Gates Gorges, but there are only a few in the area of the Svinița village, regardless of the nice sightseeing potential and the Tricule fortress from Svinița, (BRAD et al., 2018). A higher awareness will lead to a greater area development; this will need to start step-by-step, from a good signalling (in field and on the internet) to specialized guides, souvenirs, accommodation and nourishment locations development.

MATERIALS AND METHODS

The presented materials are the result of a field study carried out in 2020-2021, through the direct analysis of the described formations as well as on the basis of documentation in the IGR archive, existing literature and MNG collections. The sites were also analysed on this occasion from a geotourism (ecotourism) perspective, and also in terms of the physical condition, their degree of accessibility or possible protection, in case they are of scientific importance and need special protection measures, as scientific reserves. Taking into account these aspects, on the one hand the “strict protection” and on the other, their enhancement as geotouristic objectives and sustainable use, several aspects were observed in the field on this occasion on whose basis proposals were made for their use. In this regard, the authors consulted works in the field (ANDRĂȘANU & GRIGORESCU, 2012; BENNINGTON, 1993; HONEY, 2008), or documentation previously made for such sites, in the country or especially abroad - examples of methods or ways of public enhancement.

SITES DESCRIPTION

The "Ammonitico Rosso" site in the Vodinicki Valley (F1) is located on the right side of the Vodinicki Valley (= the Morilor Stream), on a road carved in the rock that climbs from Svinița locality towards Baia Nouă, NE of the village. The access is from Svinița, on the road that goes past the village water reservoir and climbs up a serpentine to the base of the site walls, about 800 m from the last house. The site represents a natural opening in the right side of the valley with rare forest, with stratified limestone walls, with slope variations from vertical to sloping (60°), relatively steep (but accessible for free climbing), with a maximum height of about 35 meters and a length of about 260 meters. This site represents the Stratotype of the Greben Formation (POP & GRIGORE, 1997; GRIGORE, 1998; POP, 1998) (Fig. 3).

Figure 3. Vodinicki Upper Jurassic: (a) Outcrop of nodular limestones (Upper Kimmeridgian – Lower Tithonian) - Greben Formation on the right slope of Vodinicki Valley (North-East from Svinița village); (b) ammonite – *Pachysphinctes* sp. (Richteri Zone).

The succession opened here was previously studied, in the 50s and 60s, by RĂILEANU (1953), who also named the open rocks packages: "the horizon of the upper nodular limestones" and the "horizon of compact limestones", corresponding to the members later separated by POP (1998).

Lithologically, the lower Member is composed, mainly, of red nodular limestones, with a high marly content, at certain intervals, while the upper Member is composed of subnodular and fine limestones, grey or green, with greenish marly films (details in POP, 1998).

The age was attributed based on the fossils contained; the association mainly includes ammonites (RĂILEANU & NĂSTĂSEANU, 1960; GRIGORE, 1998, 2000) (Plate 1, Figs. 2-6) and aptychi (RĂILEANU et al., 1956; TURCULEȚ & GRIGORE, 2006), but also other fossil remains: belemnites, brachiopods, micro-fossils - calpionellids (POP, 1986, 1998), and others.

Some levels are rich in fossils, with numerous especially ammonites and, poorer levels, or which preserve partially laminated fossils (especially at the top of the formation). The age of the deposits includes the Upper Kimmeridgian - Lower Berriasian(?) range, partly established on the basis of ammonite associations (the range of *Acanthicum – Richteri* zones; GRIGORE, 1998) and the upper on calpionellids (POP, 1998). In this outcrop, it should be noted that the deposits are folded and tectonized (faulted).

Cretaceous site South Svinița (**F2**) - is an artificial opening mostly in the excavation of the road DN57 (Fig. 4), between the valleys Vodinicki and Iardumavacia, from the entrance in Svinița to Orșova, about 1 km long. The height of the openings varies from a few meters to a maximum of 10 meters, especially where the limestones of the Murguceva or Greben formations are open (between the Murguceva and Iardumavacia valleys). Access to openings is relatively easy, by road, through open areas in parapets, or directly where they are missing; for public access, however, summary arrangements are needed. The Lower Cretaceous deposits of the Murguceva and Svinița formations are open in this site (AVRAM, 1976; 1984).

The history of the research of these Cretaceous deposits also begins in the Austro-Hungarian period with studies on the ammonite fauna (TIETZE, 1872; UHLIG, 1883), later also of the contained microfossils (RĂILEANU & POPESCU, 1964) and of the litho- and detailed biostratigraphy of the formations that were to be placed in the geological map 1:50,000 sheet Svinița (RĂILEANU et al., 1969; BOLDUR & AVRAM, 1972; NĂSTĂSEANU & AVRAM, 1986).

Detailed paleontological and biostratigraphic studies were carried out by POP (1986 - calpionellids), ANTONESCU & AVRAM (1980 - dinoflagellates), TURCULEȚ & AVRAM (1995 - aptychi), and mainly, Emil AVRAM (ammonites - 1978, 1994, etc.).

From a lithological point of view, the Murguceva Formation (Upper Tithonian - Lower Hauterivian) is composed mainly of stratified limestones (Majolica-type facies), with fine intercalations of grey marls, while in the Svinița Formation (Upper Hauterivian - Albian) it develops a marly, stratified facies (centimetre grey marls) with rare siliceous nodules, elongated (stratiform chert), towards the upper part increasing the detrital intake.

The fossils found in the two formations are rare and most of the time, they are kept deformed (crushed), especially in the marls of the Svinița Formation. Ammonites dominate the association, but bivalves, belemnites, aptychi and others are also found. A peculiarity for some ammonites from the marly levels would be their preservation in pyritized / limonitized form (Fig. 4d; Pl. 1, Figs. 7-9).

Figure 4. Outcrop of cretaceous deposits in the National Road DN57 (South from Svinița village): (a+b) Murguceva Formation (Upper Tithonian – Lower Cretaceous) - on the left bank of the Danube River; (c) Svinița Formation (Lower Cretaceous – br – ab).
(d) ammonite – *Phyllopachyceras* sp. (Hauterivian).

The site "Ammonitico Rosso" from Greben (**F3**) - is also an artificial opening mostly in the excavation of the DN57 road (Fig. 5 a-c), northwest of Svinița commune (about 2.5 km to Moldova Nouă), until the opening of the Saraorski Valley. Here, from the Saraorski valley, where a wide fold is visible (Figs. 5b, 2) and up to the Varnicika valley, the deposits of the Zelište Formation (Oxfordian - Lower Kimmeridgian), the Greben Formation (Kimmeridgian - Upper Tithonian) and the Murguceva Formation (Upper Tithonian - Lower Hauterivian), in continuity of sedimentation, are open nodular, subnodular and fine limestone, stratified, monoclinic (approximately 45^{o} to the east - southeast). The height of the outcrop is about 10 meters, keeping it just as open on about 300 m long, until the first brook (back to Svinița), where the deposits are also tectonized (Fig. 5c). The stone parapet is continuous but less than 1.50 m high and relatively accessible, in the area there is also a recently arranged parking lot (along with the road).

Figure 5. Outcrop of Upper Jurassic deposits in the National Road DN57 (North from Svinița village) – the new one: (a) Panorama of the Greben Formation (Upper Kimmeridgian to Lower Tithonian deposits – nodular and subnodular limestones succession) on the left bank of the Danube River; (b) Left side of the outcrop (northern) with a large anticlinal of the Zelište Formation (Oxfordian to Lower Kimmeridgian), near the Saraorski valley; (c) Right side of the outcrop (southern) with a large zone tectonized – folded, in the Murguceva Formation (Upper Tithonian to Berriasian).

The nodular, reddish marly packages contain a richer fauna (ammonites, belemnites, aptychus, etc. - Figs. 6a; b) while the subnodular limestones, those with cherts or like the Majolica type are poorer in fauna.

Figure 6. The new outcrop of Upper Jurassic deposits (Greben Formation) in the National Road DN57 (North from Svinița village): (a) Belemnite; (b) Detail of nodular limestones with small ammonites (Kimmeridgian-Lower Tithonian).

To date, biostratigraphic studies in this outcrop are brief and have focused on Cretaceous age portions (Avram, 2000); note the presence in the subnodular limestones above those with high content in reddish marls of ammonite *Richterella richteri* (Oppel) (Pl.1, Fig. 1) which attests the *Richteri* Zone (upper part of the lower Tithonian) in this outcrop.

CONCLUSIONS

This paper briefly presents two sites that open formations of the Upper Jurassic relatively recently analyzed in detail, along with the most accessible site for the Lower Cretaceous formations, and we join the opinion of AVRAM (1995) in the work "Svinița (Banat) region of international paleontological and biostratigraphic importance" in which he pleads for this region (Svinița) as "one of the richest fossiliferous regions in the interval between the Middle Jurassic and the Aptian of the Tethys Domain" which deserves a special attention, both scientifically (as reservations), as well later, for touristic aims, in an organized way). A profitable balance should be maintained for the future of both natural heritage and its non-destructive capitalization, as both science and tourism have the same ultimate target, the general public.

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Plate 1

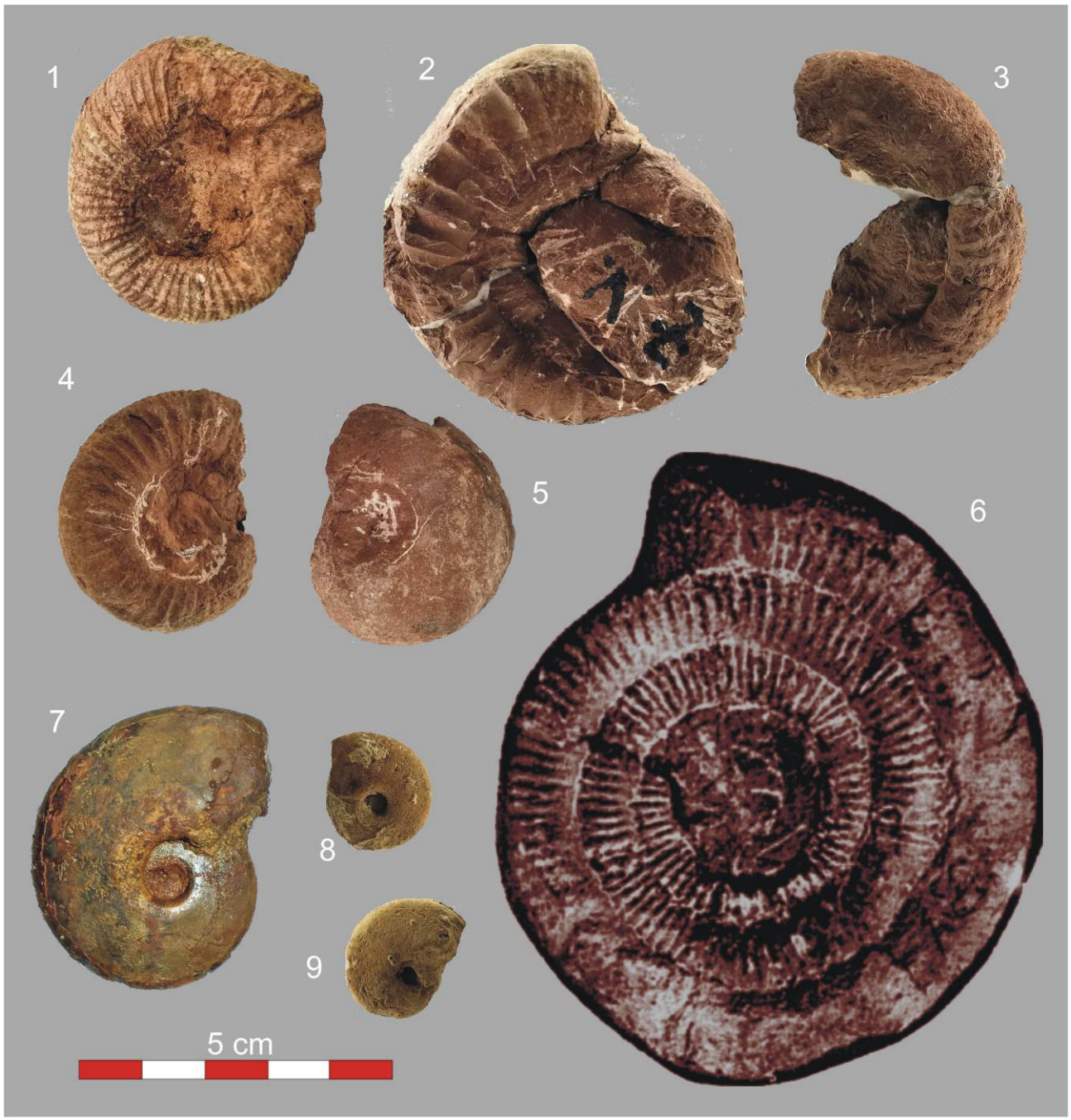

Plate 1 figures: 1. *Richterella richteri* (Oppel) Lower Tithonian (Richteri Zone) – Greben Formation (outcrop F3); 2. *Pseudokatroliceras olorizii* n.sp. Lower Tithonian (Verruciferum Zone) – Greben Formation (outcrop F1); 3. *Torquatisphinctes laxus* (Oloriz) Lower Tithonian (Hybonotum Zone) – Greben Formation (outcrop F1); 4. *Discosphinctoides* cf. *stenocyclus* (Fontannes) Upper Kimmeridgian (Beckeri Zone) – Greben Formation (outcrop F1); 5. *Schaireria avelana* (Oppel) Lower Tithonian (Zone) – Greben Formation (outcrop F1); 6. *Mesosimoceras cavouri* (Canavari) Upper Kimmeridgian (Cavouri Zone) – Greben Formation (outcrop F1); 7. *Leopoldia levigata* Busnardo et Thieuloy Hauterivian – ?Svinița Formation (outcrop F2); 8. Phylloceratidae indet. Hauterivian – Murguceva Formation (outcrop F2); 9. *Phylloceras* sp. Hauterivian – Murguceva Formation (outcrop F2).