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NEW PROPOSALS FOR PROTECTED NATURAL AREAS IN THE RARĂU SYNCLINE (EASTERN CARPATHIANS, ROMANIA) I. JURASSIC

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Abstract

Rarău Syncline represents a significant structural-geological unit of the Median Dacides (Eastern Carpathians) with conspicuous implications in the understanding of the evolution of the Alpine-Carpathian belt. This paper selects several Jurassic sedimentary outcrops and brings paleontological and stratigraphical data as arguments for the necessity of their protection and conservation in the near future. The following outcrops are proposed: the Early Liassic olistolith of Praşca peak, the mid-Liassic olistolith of Praşca stream, the ophiolites with sedimentary enclaves of Măcieş hill, the Aalenian olistolith of Măgura hill, the Bajocian klippe of Pojorâta, the Dogger outcrop of Tătarca stream, and the Bathonian exotic block of Valea Seacă stream. In the exposure of each outcrop several steps were followed: kind of protected area (after IUCN classification), geo-tectonic unit, lithostratigraphy, access, scientific arguments, rEason of protection, present phase of conservation and protection; protection measures, historical approach, collections.

Key words: geoconservation, paleontological outcrops, Jurassic, Rarău Syncline, Romania.

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General data

Protection and conservation of geological sites gained new dimensions in the last decades being considered a new domain of the applied geology – geoconservation. The basic concepts (geodiversity, geological heritage, geosites/geotopes, geopark, geoeducation), as well the defined structure, tools and activities are the main invoked arguments. This way, geoconservation comes to complete the human care on the nature, respectively on the "non-living half" of the nature (Andrăşanu, 2006).

This paper proposes a selection of several geosites from the Rarău Syncline, which could become new protected natural areas from the geological point of view. Here we focus on the Jurassic rocks. The main criteria of selection reside in the paleontological and stratigraphical patterns of the outcrops (impressive richness in fauna, rare and significant fauna for the Alpine Mesozoic, outcrops which offered the holotypes for new species, evolution and paleogeographical implications of fauna, unique appearance of the stage in the Eastern Carpathians etc.).

The Rarău Syncline was named after the Massif of Rarău (1652 m altitude of its highest peak), one of the most stately massif in this part of the Eastern Carpathians. It represents an outstanding structural-geological unit of the Median Dacides (built up by a crystalline basement, a Mesozoic sedimentary cover, and magmatic rocks), which offers several reference outcrops for the understanding of the evolution of the Alpine-Carpathian belt. The peculiar geological features are associated with spectacular landscapes, very rare species of actual flora and fauna and they determined the statement of well-known protected areas in Romania: Pietrele Doamnei (The Lady's Sones) – Rarău Massif, Pârâul Cailor (Horses Stream) – Fundu Moldovei, "Stratele cu *Aptychus"* ("*Aptychus* Beds") – Pojorâta, Piatra Buhii (Stone of Owl) – Câmpulung Moldovenesc, Moara Dracului (The Devil mill) – Câmpulung Moldovenesc, Codrul secular de la Slătioara (The secular forest of Slătioara), Peştera liliecilor (The Bats Cave) – Rarău Massif, Todirescu and Răchitişul Mare areas. Two of them (Pârâul Cailor – Fundu Moldovei, and "Stratele cu *Aptychus"* – Pojorâta were protected by law through the efforts of first author during the 1970s and 1980s.

New proposals of protected natural areas, Jurassic in age

Jurassic presence in the Rarău Syncline was signaled since the second half of the 19th Century by Mojsisovics (1879) who discovered the Dogger outcrop of the Fundu Pojorâtei stream. From this beginning until today, subsequent researchers have mapped and studied various Jurassic rocks. Almost all outcrops described herein belong to the allochthonous Transylvanian Nappes (Săndulescu, 1984) as olistoliths, klippes and exotic blocks in the Cretaceous wildflysh (Uhlig, 1900; Popescu and Patrulius, 1964; Turculeţ, 1965, 1968, 1970, 1970 a, 1971, 1971 a, 1976, 1984, 1991, 2002, 2004, 2004 a; Mutihac, 1965, 1968; Stănoiu, 1967a, b; Săndulescu, 1976, 1985; Ţibuleac 2002,

2005, 2008). Only the outcrop of the Tătarca stream from the western flank of the syncline represents the autocthonous Bucovinian Nappe (Stănoiu, 1967, Mutihac, 1968, Turculeţ, 1971, 1978, 2001).

1 The Early Liassic olistolith of Praşca peak

Kind of protected area: scientific reservation. Category: IUCN I. Surface: 0.5 ha.

Geo-tectonic Unit: Median Dacides, Transylvanian Nappes (Olt), Rarău Syncline.

Lithostratigraphy: olistolith held in the Cretaceous wildflysh; it is made up of very fossiliferous red nodular/pseudonodular limestones and clayey limestones.

Access: There are three access routes: from Câmpulung Moldovenesc through Valea Seacă stream, respectively Mesteacăn valley, and from Pojorâta through Fundu Pojorâtei valley (Fig. 1). The most convenient access is through Valea Seacă stream: after entering the Cretaceous wildflysch area, on must follow the way of chariots which climbs to the peak of Praşca hill (ca. 1.5 km long); a summer house, hid under the crest is one sign; then the red soil, and an easy flat plot few meters there are the another marks which announce the olistolith. If we decide to reach it other way we have to go along the Mesteacăn valley towards its springs; after leaving the forest and arriving in the crest area, we must follow the marked way to Rarău Peak for several tens of minutes; on the slope of Praşca peak towards Valea Seacă stream, we can meet the same summer house as main reference point. From Pojorâta, we must go on Fundu Pojorâtei stream until we leave the village, then to follow other way of chariots untill we will cross the same crest way which is prolonged from Mesteacăn valley.

Scientific arguments: The olistolith is built up by regular bedds consisting of red nodular/pseudonodular limestones, clayey limestones and marls into an „ammonitico rosso" facies assigned to „Adnet facies" by Uhlig and subsequent researchers or a transitional facies between Adnet and Hierlatz (Turculeţ, 1965). There are many similarities with the mentioned Austrian Liassic, but the direct afilliation is not well proved. The diggins made until now showed over 50 meters in length and over 6 meters in height for the olistolith. It has an upside-down inclination in the Cretaceous wildflysh demonstrated by the relative position of *in situ* fossiliferous beds. The diggings show beds yielding ammonites from the *Arnioceras semicostatum* T.-r. Zone occur up-slope from beds yielding ammonites of the *Echioceras raricostatum* T.-r. Zone (Ţibuleac 2005). Other several specimens of ammonites index-taxa encountered between these zones were used as arguments for the continuity of sedimentation. Also, the presence of Hettangian, and Pliensbachian respectively, on the extremes of researched beds could be documented after future diggings.

The valuable and rich ammonite fauna (over 60 taxa), and also the alga, foraminifers, bivalves, gastropods, aulacocerids, brachiopods, crinoids etc. specimens which have been documented here during the time confer the uniqueness of this olistolith in the Rarău Syncline (and an important significance for the Liassic of Eastern Carpathians, and for the Alpine-Carpathian belt, respectively).

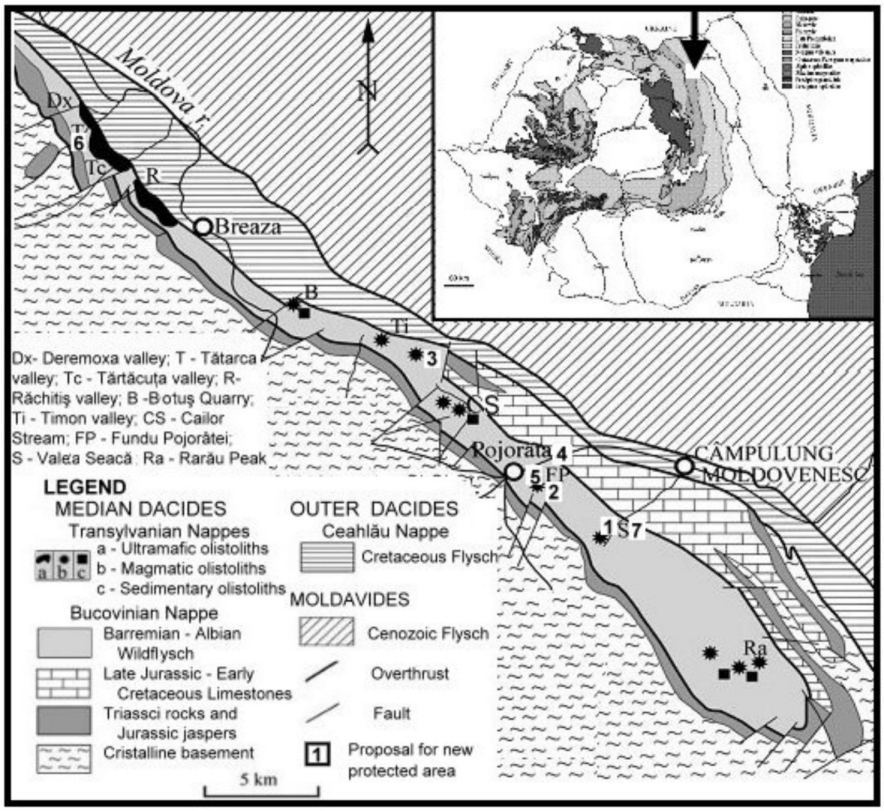

Fig. 1 Geological sketch of the Rarău Syncline with the new proposals for protected natural areas (graphic groundwork after Hoeck et al., 2008).

Six new species were erected by Uhlig (1900) from this olistolith: *Rhacophyllites (=Harpophylloceras or Juraphyllites) bucovinicus, Arietites (=Paltechioceras) romanicus, A.(=P.) wähneri, A.(=P.) herbichi, A(=P.). bösei,* and *Spiriferina aequiglobata.*

Arietites (=Paltechioceras) romanicus is the best-known species erected by Uhlig at Praşca Peak; it was signaled at Robin Hood's Bay – United Kingdom (*P. aff. romanicum* - Hesselbo et al., 2000), Dolomites Alps – Linz, Austria (*P. romanicum* - Blau, 1998), Central Apennine – Italy (*P. aff. romanicum* - Dommergues et al., 1994), Bakony Mountains-Hungary (*P. aff. romanicum* Geczy and Meister, 2007), Central and Eastern

Pontides – Turkey (*P. romanicum, P. romanicum anatolicum* – Bremer 1965, fide Blau, 1998; *P. romanicum* - Alkaya and Meister, 1995).

Of special interest is the phylloceratid *"Racophyllites" bucovinicus,* species which shows intermediate features between *Harpophylloceras eximium, Meneghiniceras lariense* and *Juraphyllites mimatens*; from these reasons, Turculeț (1968) proposed a new subgenus of *Harpophylloceras, Bucoviniceras* respectively.

Also, the big size ammonite specimens found in the olistolith (*Coroniceras (Coroniceras) lyra, C. (Paracoroniceras* cf. *charlesi, Zetoceras pseudo-oenotrium, Z. oenotrium* etc. (Țibuleac, 2008) argue for its valuable significance and support our proposal.

Aside from ammonite specimens other fossils were reported as well: bivalves (*Pecten, Lima),* gastropods (*Trochus*), brachiopods (*Spiriferina, Koninckina, Waldheimia, Orthotoma*), echinoderms (*Prionocidaris, Pentacrinus (Extracrinus), Diademopsis* etc.), foraminifers (*Involutina liasica* (JONES) etc.

Reasons of protection: The impressive richness in Liassic fauna (especially ammonites) and its implications for taxonomy, evolution and paleogeography are the main scientific reasons.

Present phase of protection: The olistolith is covered by soil and grass; there is a tendency to cut the conifer trees and also to use the stones for the foundation of new summer houses. Few diggings have exposed the Liassic rocks.

Protection measures: The olistolith should be isolated through a fence; the cutting of trees in the area must be stopped; also the diggings must follow only the research reasons; an identification panel with the main data on the olistolith is also necessary. The new agreement with the owner of the land and future connections with the local administration and non-governmental organizations could improve the protection of the olistolith. A file under the framework of Law No. 462/2001 and Ministry Ordinance No.850/2003 must be drawn up.

Historical approach: The olistolith was discovered by Uhlig (1900); then, new geological data were produced by Trauth (1907), Popescu and Patrulius (1964), Turculeț (1965-2004), Popa and Patrulius (1996), Turculeț et Țibuleac (2002), and Țibuleac (2005, 2008). The authors have described numerous fossil taxa.

Collections: Liassic fossils of this olistolith can be found in the Museum of Geological Institute of Austria, in Vienna, Geological Institute of Romania in Bucharest, Museum of orginal specimens „Paleontology-Stratigraphy", museum held by the Department of Geology, University „Al. I. Cuza" Iaşi, Țibuleac's collection.

2 The Mid-Liassic olistolith of Praşca Stream

Kind of protected area: natural monument. Category: IUCN III. Surface: - 0.15 ha.

Geo-tectonic Unit: Median Dacides, Transylvanian Nappes – Rarău Syncline.

Lithostratigraphy: The olistolith is built up by massive, grey limestones comprised by the Cretaceous wildflysh.

Access: To find this olistolith one must go from the Pojorâta village along the Fundu Pojorâtei stream up to the confluence with the Praşca stream; then, we must follow the thalweg of the last one over a distance 400 m (Fig. 1); in the right slope on the stream there is the massive block of limestone.

Scientific arguments: The olistolith consists of grey or reddish-rusty limestones of 3-4 meters as long and 1-2 meters high; numerous fossil taxa including belemnites, brachiopods, and echinoderms were documented for this outcrop. The richness in belemnite rostra, with different dimensions and various orientation gives the singularity of this fossiliferous point in the Rarău Syncline. *Passaloteuthis paxillosus* (SCHLOTH.), *Nannobelus acutus* (MILL.) *Acrocoelites* cf. *subrostriformis* (VOR.) – belemnites; then *Cincta nummismalis* (LAM.), *Spiriferina villosa* QUENST., *S.* cf. *alpina* OPPEL, *Pissirhynchia* sp., *Moisseievia* sp. etc. were described. Still on, the microfauna are more abundant: *Involutina liasica* (JONES), *I. turgida* KRYSTAN, *Turrispirillina* aff. *conoidea* (PAALZOV), *Vidalina martana* FARINACCI, *V. zujovicii* RADOICIC, *Rectoglandulina tenuis* BORNEMANN, *Nodosaria* aff. *mutabilis* TERQUEM, *Trocholina* cf. *conica* (SCHLUMBERGER*), Cornuspira* sp., *Ophthalmidium* sp., etc. – foraminifers and *Globochaete alpina tumido-punctata* TURCULEŢ – algae were quoted here (Turculeţ, 1971, 1971 a, 2004).

Reason of protection: The spectacular belemnite and brachiopods fauna and the impressive richness in mid-Liassic microfauna are the main reasons of protection.

Present phase of protection: Because of its relative isolation and its hardness, the olistolith is in good state of preservation. Basic measures of protection are nevertheless recommended.

Protection measures: The isolation of the olistolith through a fence, and a panel with the main scientific information are necessary; future connections with the local administration and non-governmental organizations will be helpful.

Historical approach: The geological-paleontological value of the occurrence was documented by Stănoiu (1967 a) and Mutihac (1968), and from the beginning of the 1970s by Turculeţ (1971, 1971 a, 2004).

Collections: Museum of orginal specimens „Paleontology-Stratigraphy", museum held by the Department of Geology, University „Al. I. Cuza" Iaşi.

3 The ophiolites with sedimentary enclaves of Măcieş hill

Kind of protected area: nature reserve. Category: IUCN IV. Surface: 2 ha.

Geo-tectonic Unit: Median Dacides, Transylvanian Nappes – Rarău Syncline

Lithostratigraphy: The ophiolites form a tectonic path with sedimentary enclaves of Triassic and Liassic in age.

Access: From Holohoşca village (Fundu Sadovei) we must follow the Măcieş stream to its springs untill we leave the forest ca. 2 km behind; then we have to choose the straight way that climbs towards the crest (ca. 1 km) and to the mentioned ophiolitic path (Fig. 1).

Scientific arguments: The ophiolites (diabases) formed a large tectonic path over the crest of Măcieş hill; mass contains flows of pillow-lava and also enclaves of sub-metric blocks of sedimentary rocks: pisolitic white limestones with foraminiferal genera *Meandrospira* and *Pilammina* (Middle Triassic); grey limestones with *Aulotortus* foraminiferal genus (Fassanian – Cordevolian); brown organogenic limestones with small brachiopods (*Thecospira, Dioristella, Amphiclina* etc.), molluscs (*Cassianella, Radulonectites, Syringoceras* etc.) (Early Carnian); red-purple limestones with crinoids (*Pentacrinus*), nautiloids (*Michelinoceras*) etc. (? Carnian); pink-orange limestones, fragments of ancient biostromes with brachiopods (*Rimirhynchopsis, Tetractinella, Zeilleria, Austriella, Labala)*, molluscs (*Plagiostoma, Chlamys*) (? Norian); white, lumashellic limestones, with very frequent mollusc specimens (*Modiolus, Bakevellia*, *Waagenoperna, Cassianella, Retroceramus, Propeamussium*, *Lima, Mysidioptera, Plagiostoma, Parallelodon, Myoconcha*, *Tutcheria, Sissena, Oonia, Placites* etc.) (Carnian – Early Norian); grey-light, breccioid limestones with *Colospongia*, *Aulotortus, Involutina* etc. (Norian); red-purple, massive limestones with brachiopods and bivalves (*Spiriferina, Labala, Dinarella, Rimirhynchopsis, Plagiostoma, Ornitopecten*, *Tutcheria* etc.) and also several foraminifers (*Vidalina carinata (*LEISH.), *Involutina communis* KRIST.*, I. liasica* (JONES) (Late Triassic with Liassic neptunian dikes); fine purple limestones with *Involutina liasica* and *I. turgida* (Middle Liassic).

Macro and microfauna identified in the sedimentary enclaves of diabases argue for a large interval time, from Middle Triassic to Middle Liassic.

Reason of protection: The impressive richness in Triassic and Liassic fauna (over 70 taxa), the uniqueness of tectonic-structural appearance and the evidence of post-Middle Liassic eruptions in the original area are the main arguments of the protection.

Present phase of protection: The ophiolitic body has a relative good stage of preservation, but fragmentations and alterations of rocks were observed.

Protection measures: It will need the isolation of the area through a fence and the identification throughout a panel.

Historical approach: The ophiolitic path is known since 1968 (Mutihac), subsequent researchers added new data (Săndulescu, 1976, 1985; Turculeţ, 1987, 1989, 1991).

Collections: Important collections of fossil brachiopods and mollusks were held in the Museum of orginal specimens „Paleontology-Stratigraphy" – Department of Geology, University „Al. I. Cuza" Iaşi, and also at Geological Institute of Romania (Mutihac and Iordan' collections).

4 The Aalenian olistolith of Măgura hill

Kind of protected area: nature reserve. Category: IUCN IV. Surface: 0.5 ha.

Geo-tectonic Unit: Median Dacides, Transylvanian Nappes – Rarău Syncline.

Lithostratigraphy: The olistolith represents black clays with ellipsoidal blocks of marl; it is comprised in the Cretaceous wildflysch.

Access: From the cross of railway and highway near to Pojorâta, we must go to Pojorâta untill the first torent coming from Măgura hill; then, we climb around 150 m on the torent and in its right slope there is the invoked outcrop of black clays, with included marl blocks (Fig. 1).

Scientific arguments: There are lens of grey, fine micaceous marls, and sandy limestones of metric dimensions, included into a leafy and brittle mass. The lens show an evident stratification and a more light colors on the alteration surfaces.

From the marls and limestones Turculeț (1971, 1982, 2004) have recorded a rich fauna of mollusks: *Leioceras opalinum* (REIN.), *L. comptum* (REIN.), *L. goetzendorfensis* DORN., *L. costosum* QU., *L. giganteum* TURCULEȚ, *Pleydellia leurum* BUCK., *Grammoceras subcomptum* BR., *Costileioceras sinon* (BAYLE), *Tysanoceras* sp., *Ludwigia* sp. etc.) – ammonites, then (*Rhabdobelus exilis* (d'ORB.), *Belemnopsis subblainvillei* (DESH.) – belemnites, (*Entolium demissum* (PHILL.), *Steinmannia bronni* (VOLTZ), *S. radiata* GOLDF.) – bivalves, etc.

The presence of Aalenian is certainly argued by the ammonites taxa; in the lowest part the bivalve species (*Steinmannia bronni)* suggests the transition to Toarcian.

Reason of protection: This is the only appearance of Aalenian in the Eastern Carpathians, and even more, it contains great number of mollusks, especially ammonites.

Present phase of protection: The outcrop is on the slope and shows a big instability because the soft consistence of rocks; the alteration and the washing of rocks by surface waters are also intensive.

Protection measures: First, it will need an increase of slope stability through the stopping of denudation and fixing the rocks; also a hence needs to be built to protect the outcrop against domestic animals; a panel of identification with scientific data is also necessary.

Historical approach: The fossiliferous outcrop has been discovered by Turculeț (1965) and studied since then by the same author (1966, 1971, 1982, 2004 b).

Collections: The faunal associations collected from this outcrop are stored in the Museum of orginal specimens „Paleontology – Stratigraphy" – Department of Geology, University „Al. I. Cuza" Iaşi.

5 The Bajocian klippe of Pojorâta

Kind of protected area: nature reserve. Category: IUCN III. Surface: 1.5 ha.

Geo-tectonic Unit: Median Dacides, Transylvanian Nappes-Rarău Syncline

Lithostratigraphy: The mid-Jurassic klippe is made up by fossiliferous sandstones and is included in the Cretaceous wildflysch.

Access: We must follow the Fundu Pojorâtei stream towards Praşca hill; after 400 m from the confluence with Moldova river, in the thalweg and in its right slope the klippe outcrops (Fig. 1).

Scientific arguments: The outcrop shows a large development in comparison with previous olistoliths: over 200 m long and several tens of meters in height (the real

dimensions are not well documented by diggins). The lithology consists of black, hard sandy limestones, with trigoniids and ammonites; grey organogenic sandstones with lumashellic levels of *Entolium, Ostrea, Pholadomya* and brachiopods; grey, hard, fine stratified marls with belemnites.

The fauna is quite abundant: *Stephanoceras humphriesianum* (SOW.), *Sonninia* sp., *Belemnopsis latesulcatus* (d'ORB.), *Astarte elegans* ZIET., *Limatula gibbosa* (SOW.), *Myophorella* cf. *eichwaldi* (SOW.), *Trigonia (Clavitrigonia*) sp., *Entolium demissum* (PHILL.), *Pholadomya cordata* QU., *Acantothyris spinosa (*SCHI.), *Lobothyris buckmani* (DAV.), *L. perovalis* (SOW.), *Epithyris sub-maxillata* (MORRIS) etc. The index taxa argue without doubts for the Early Bajocian.

Reason of protection: The klippe concentrates a valuable paleontological inventory for the Lower Bajocian of Romanian Carpathians on a small area, easy to access; it also is important for the understanding of the paleontological and structural-tectonic framework of the northern crystalline-Mesozoic sector (Median Dacides of the Eastern Carpathians).

Present phase of protection: The klippe occurs in the farmstead's garden being affected by domestic activities. The greatest damage is generated by the garbage deposition and building activity. In time, this situation can obstruct the direct observations of the rocks and of the fossil specimens.

Protection measures: The approach of the owner and his information on the importance of this klippe and on the necessity of its preservation. A panel of identification will also be necessary. The implications of the local administration and non-governmental organizations will be helpful. The inclusion of the klippe in the geotouristic circuits will increase the scientific resonance and social impact of this outcrop.

Historical approach: The fossiliferous klippe is known from the second half of the XIX-th Century (Mojsisovics, 1879), when the first data on the fossil taxa were noted. Moldovan (fide Gr. Popescu et al., 1964); rediscovered it, and Turculeț (1968, 1971, 2004 b) made several detailed studies.

Collections: The identified fauna (around 45 taxa) is stored in the Museum of orginal specimens „Paleontology-Stratigraphy" – Department of Geology, University „Al. I. Cuza" Iaşi.

6 The Dogger outcrop of Tătarca Stream

Kind of protected area: nature reserve. Category: IUCN IV. Surface: 0.5 ha.

Geo-tectonic Unit: Median Dacides, Bucovinian Nappe – Rarău Syncline

Lithostratigraphy: The outcrop shows red limestones, sometimes pseudo-oolitic and detrital limestone lens.

Access: From the Benia village we must follow the way of Tătarca Stream ca. 3.5 km; then we meet the rocks of internal flanck of Rarău Syncline pointed out by the

dolomites, limestones and jaspers. The outcrop appears on the left slope of the stream, ca 30 meters above the stream (Fig. 1).

Scientific arguments: The Dogger consists by red limestones, detrital or massive hard limestones, sometimes pseudo-oolitic limestones, sometimes fine or lumashellic or ferruginous limestones lens. The height is about 20 m. The Dogger lays transgressively on the Triassic dolomites and white limestones and supports the Callovian-Oxfordian jaspers.

From these limestones a rich fauna was documented: *Entolium demissum demissum* (PHIL.), *E. demissum postplicatum* TURCULEȚ, *E. demissum semistriatum* TURCULEȚ, *Bositra buchi* (ROEM.), *Chlamys subtextorius* (GOLDF.), *Placunopsis duriuscula* (PHILL.), *Bullatimorphites* sp. etc.) – mollusks taxa, *Septocrurella, Pycnoria, Kallyrhynchia, Antiptychina, Rhynchonelloidea* etc. – brachiopods, and *Peltastes, Holectypus* echinids.

Reason of protection: The mentioned geological section on the Tătarca Valley represents the only one outcrop with the Dogger rocks of Bucovinian Nappe in the Rarău Syncline.

Present phase of protection: The outcrop is quite isolated and exhibits a good stage of preservation. New buildings and several local activities could affect it in the future.

Protection measures: It will need a protection fence, an identification panel and the involvement of local authorities to avoid construction or industrial activities on that area.

Historical approach: The outcrop is known from the 1960s (Mutihac, 1965; Stănoiu, 1967; Turculeț, 1971, 1998, 2000, 2004 b).

Collections: The richest fossil associations from this outcrop are held in the Museum of orginal specimens „Paleontology-Stratigraphy" – Department of Geology, University „Al. I. Cuza" Iaşi.

7 The Bathonian exotic block of Valea Seacă stream

Kind of protected area: natural monument. Category: IUCN III. Surface: 0.1 ha.

Geo-tectonic Unit: Median Dacides, Transylvanian Nappes – Rarău Syncline.

Lithostratigraphy: Exotic blocks represent black limestones, incorporated in the Cretaceous wildflysch.

Access: We must follow the road on Valea Seacă stream, and we will stop around 350 meters after the last outcrop of dolomites which appears on the right slope of the stream. The exotic block is behind a local farmstead, quite on the last part of a torent which comes from the Bodia hill (Fig. 1).

Scientific arguments: The Bathonian consists of black, very hard limestones, with a pseudo-oolitic aspect, and several slightly feruginous levels. The fossil fauna includes ammonites: *Oxycerites behredseni* (WETZ.), *O. fallax radiatiformis* (WETZ.), *Flabellisphinctes* sp., *Cadomites* sp., *Caumatosphinctes polygyralis* BUCKM., *Garantiana* sp. etc.), bivalves, brachiopods etc. A similar fauna was not recorded so far in this part of the Eastern Carpathians.

Reason of protection: The unique fauna in the Eastern Carpathians area arguments the protection of this small block (several cubic meters).

Present phase of protection: There is no protection for this exotic block, which is the place for garbage deposition.

Protection measures: It will need talks with the proprietary and the surrounding of the block with a fence; also to put an identification panel.

Historical approach: The outcrop was discovered and turning to account by Turculeț (1969), new data being added also by Turculeț (1971, 2004 b).

Collections: Fauna of ammonites, brachiopods, bivalves etc. is held in the Museum of orginal specimens „Paleontology-Stratigraphy" – Department of Geology, University „Al. I. Cuza" Iaşi.

Conclusions

The researches made during the time in the Rarău Syncline revealed many reference outcrops with an outstanding significance in the evolution of the Alpine-Carpathian belt. The paper proposes a selection of the Jurassic sedimentary outcrops and argues through the stratigraphical-paleontological data the necessity of their protection. The main criteria of selection reside in the paleontological and stratigraphical patterns of the outcrops (impressive richness in fauna, rare and significant fauna, outcrops which offered the holotypes for new species, evolution and paleogeographical implications of fauna, unique appearance of the stage in the Eastern Carpathians etc.).

Six outcrops of the allochthonous Transylvanian Nappes and one of the autochthonous Bucovinian Nappe were selected: Praşca peak, Praşca stream, Măcieş hill, Măgura hill, Fundu Pojorâtei stream, Valea Seacă stream, an the outcrop of Tătarca stream respectively. In the exposure of each outcrop several steps were followed: kind of protected area (after IUCN classification), geo-tectonic unit, lithostratigraphy, access, scientific arguments, reason of protection, present phase of protection; protection measures, historical approach, collections. Few measures of the basic protection were invoked: identification panels, fences for the olistoliths surrounding, the contact of local administration and non-governmental organizations etc.

The paper points out the geological dowry of the Rarău syncline (Jurassic in age, in this part) and represents the basement for future activities viewing its protection and conservation under the law.

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