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

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Abstract

The protection and conservation of geological sites (geoconservation) leads firstly to the outlining of special areas for a better understanding of the evolution of the Earth, under various topics: the biodiversity of life, extinction and speciation, aspects related to the relief, climate change, global tectonics, unpredictable events etc. Given these relevant implications, as an extension to a previous paper (Turculeț and Țibuleac, 2008), new possible protected areas from the Rarău Syncline, Triassic in age, will be proposed herein: the Early Triassic klippe of Runc hill, the Mid-Triassic klippe of Piatra Zimbrului, the Norian klippe of Ciungi (Fundu Moldovei), and the Rhetian klippe of Măgura hill. Several steps were followed in the presentation of each outcrop: type of protected area (according to the IUCN classification), geo-tectonical unit, lithostratigraphy, access, scientific arguments, reasons for protection, present stage of conservation and protection; protection measures, historical approach, collections.

Keywords: geoconservation, paleontological outcrops, Triassic, Rarău Syncline, Romania

General data

The Triassic system presents a large development in the Rarău Syncline, in all the Bucovinian and allochthonous Transylvanian Nappes (after Săndulescu’s model, 1984), through marine rocks (sandstones and conglomerates, marls, dolomites and limestones). The fauna was recorded from the two mentioned kinds of nappes, but it shows an impressive

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richness and variety only in the Transylvanian Nappes. Several geological sites were already protected by law, being valuable nature reserves: the klippe of Pârâul Cailor (The Stream of the Horses), Moara Dracului (The Devil's mill), Piatra Şoimului (The Stone of the Hawk), Piatra Buhii (The Stone of the Owl). Consequently, new Triassic sites of the Transylvanian Nappes were selected and proposed for protection and conservation in the near future (fig. 1). The same criteria as in the previous paper were emphasized in the present approach: the peculiar paleontological and stratigraphical patterns (impressive richness in specimens, rare and significant fauna, the uniqueness of the fauna, the type-beds for holotypes, the implications in the paleogeographical correlation), and also the intrinsic educational value.

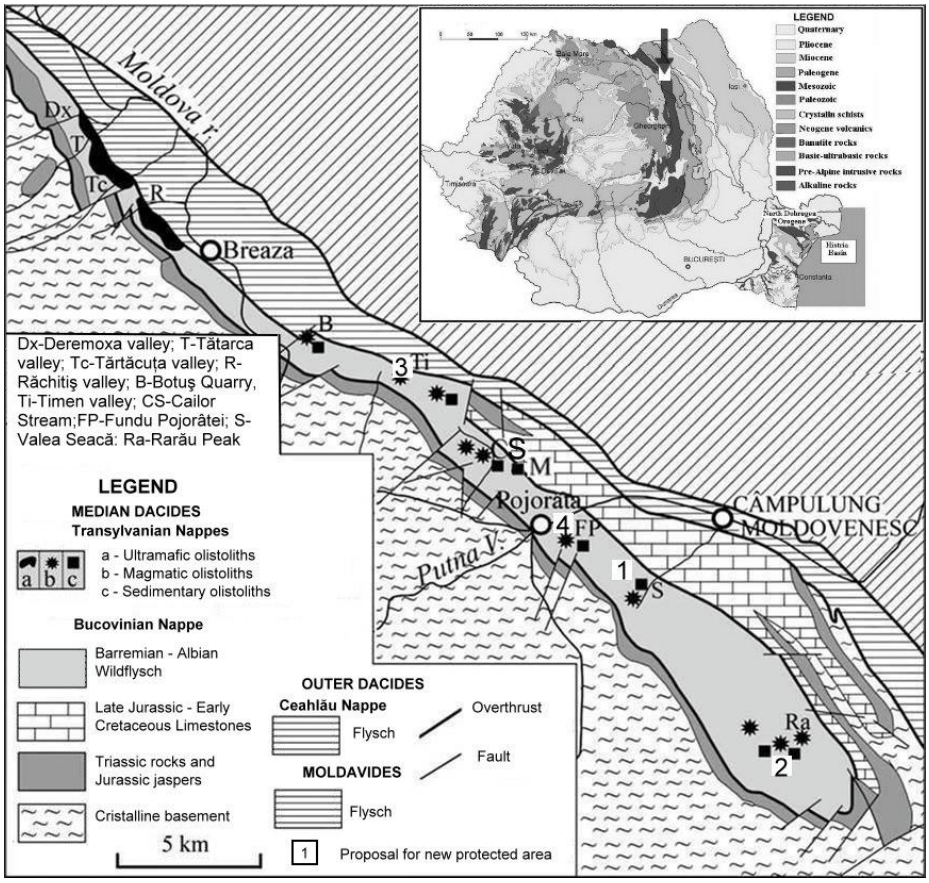

Fig. 1 Geological sketch of the Rarău Syncline with the new proposals for protected natural areas (graphic groundwork after Hoeck et al., 2009). 1-Early Triassic klippe of Runc hill; 2-Mid-Triassic klippe of Piatra Zimbrului (Stone of the Aurochs); 3-Norian klippe of Ciungi (Fundu Moldovei); 4-Rhetian klippe of Măgura hill (Pojorâta)

New proposals for protected natural areas, Triassic in age

1. The Early Triassic klippe of Runc hill

Type of protected area: natural monument. Category: IUCN III. Surface: 1 ha.

Geo-tectonical Unit: Median Dacides, Transylvanian Nappes.

Lithostratigraphy: The klippe is built of grey marls and limestones which appear almost in the middle of the Cretaceous Wildflysch; it belongs to the ancient Werfenian (Induan) stage of the Early Triassic.

Access: To find this klippe, one must follow the forest route of the Mesteacăn stream (ca. 3 km long) up to the crest area (in the hay fields with the limestone block area); after ca. 300 m, one has to leave the marked path to the Rarău peak and to descend towards the Valea Seacă stream (Dry Valley stream) on the southern slope of the Runc hill (on the left in the direction of the way).

Scientific arguments: The klippe shows a lithological succession of different kinds of marls: grey-greenish, highly thinned stratified marls; stratified clayey limestones, with thinned yellowish intercalations, and sometimes micaceous ones; grey lighted limestones in strata of several centimeters, sometimes with recrystallized calcite and bioglifs; thinned stratified marls with grey lighted nodular intercalations. The recorded fauna is frequent and significant for the Early Triassic: *Costatoria costata* (ZENKER), *Bakevellia bucovinensis* TURCULEŢ, *Neoschizodus orbicularis* BRONN, *Pseudomonotis (Claraia) inaequicostata* BENEKE, *Eumorphotis telleri* BITTNER, 1899, *Unionites fassaensis* (WISSMAN), *Entolium discites* (SCHLOTHEIM), *Parallelodon beyrichi* (STROMBEK), *Trigonodus sandbergeri* ALBERTI, "*Turbo" (Werfenella) rectecostatus* HAUER, "*T." (W.) rectecostatus altograndis* TURCULEŢ, *Naticella costata* MÜNSTER etc.; over 20 taxa were fully recorded, two of them being new for science: a species of bivalves – *Bakevellia bucovinensis* TURCULEŢ, respectively a subspecies of gastropods – "*Turbo" (Werfenella) rectecostatus altograndis* TURCULEŢ.

Reason for protection: The klippe represents the most important outcrop with Early Triassic fossils from the Romanian Carpathians.

Present stage of protection: The klippe is quite isolated and far away from any human activity; as a result, it did not undergo significant destruction.

Protection measures: The identification through a panel and a protective fence could be the first measures.

Historical approach: The fossiliferous klippe was dicovered by Uhlig (1910), but it was lost by the subsequent researchers of the area until the 60's. Turculeţ (1966) rediscovered it and improved the fossil content through several papers (Turculeţ, 1970, 1971, 2004).

Collections: The entire fauna is held in the "Paleontology-Stratigraphy" Museum of original specimens of the Department of Geology within the "Alexandru Ioan Cuza" University of Iaşi.

2. The Mid-Triassic klippe of Piatra Zimbrului (Stone of the Aurochs)

Type of protected area: natural monument. Category: IUCN III. Surface: 0.5 ha.

Geo-tectonical Unit: Median Dacides, Transylvanian Nappes.

Lithostratigraphy: red-orange (or greenish, white-grey) nodular limestones and marls which appear at the cornerstone of the Piatra Zimbrului cliff. Fossil fauna with *Daonella* specimens indicated the Ladinian age.

Access: Piatra Zimbrului can be reached on the way from the Rarău chalet to the Todirescu Peak; after ca. 2.5 km, on the relief saddle between the Rarău and Todirescu peaks, one must leave the way on the right until one reaches the calcareous cliff of Piatra Zimbrului (ca. 300 m).

Scientific arguments: At the cornerstone of the Piatra Zimbrului cliff, there is an alternation of stratified nodular limestones and marls with chert. This ribbon can be observed along a portion that is ca. 3 m high and ca. 150 m long and it is distinctly visible due to the red-orange colour of the limestone, sometimes speckled by grey-greenish small spots. The bivalves are frequent, the *Daonella* species being the most abundant, and also *Posidonia wengensis* could be encountered easily. The specimens from this outcrop were used by Turculeț (1972) to propose four of the new five subgenera of *Daonella*: *Grabella, Arzelella, Loemmelella, Pichlerelal* (and the last subgenus being *Mousonella*).

Reason for protection: The outcrop is unique through the lithology and fauna, especially the *Daonella* genus; 10 species were described, and, as mentioned above, the specimens were used to propose new subgenera: *Daonella (Grabelella) grabensis* KITTL, *Daonella (Arzelella) arzelensis* KITTL, *D. (A.) loczyi* KITTL, *D. (A.) tyrolensis* MOJSISOVICS, *D. (A.) bulogensis* KITTL, *D. (A.) longobardica* (MOJSISOVICS) KITTL, *D. (A.) indica* BITTNER, *D. (A.) tripartita* KITTL, *D. (Loemmelella)* cf. *garderana* KITTL and *D. (Pichlerella) pichleri* (GÜMBEL).

Present stage of protection: The cliff is well preserved, but it is not taken care of.

Protection measures: The same basic measure: the identification through a panel and a protective fence.

Historical approach: The outcrop is known since the 80's, when Turculeț quoted the *Daonella* association.

Collections: Most of the fauna is held in the "Paleontology-Stratigraphy" Museum of original specimens of the Department of Geology within the "Alexandru Ioan Cuza" University of Iaşi.

3. The Norian klippe of Ciungi (Fundu Moldovei)

Type of protected area: natural monument. Category: IUCN III. Surface: 0.5 ha.

Geo-tectonical Unit: Median Dacides, Transylvanian Nappes.

Lithostratigraphy: The klippe is built by red-purplish limestones, sometimes microbreccious Norian (Sevatian) in age; it appears in the Cretaceous Wildflisch.

Access: From the center of the locality of Fundu Moldovei, one must follow the way along the Timon (Timen) stream until one reaches its spring (ca. 4-5 km). After one goes through the forested area and comes out in the hay fields, one must carry on on the left way (ca. 350 m) until one reaches an elevated and forested ledge. Here, the outcrop can be found.

Scientific arguments: The klippe found there was partially exploited in the past, more precisely the white-grey limestones, for the obtaining of lime; only the red-purplish limestones remain and they bear paleontological significance. The paleofauna consists of foraminifers, porifer spicules, ammonites, nautiloids, bivalves, brachiopods, crinoids, ostracods etc. Despite the hardness of the limestone, the fossil content was improved throughout time. The fauna shows similarities with the so-called Hallstatt facies (Northern-Eastern Alps) and has several Himalayan influences.

The fauna that is common belongs to the Tethyan facies, being more abundant than in the case of the Asian region:

- over twenty species of foraminifers: *Glomospirella friedli* KRISTAN-TOLLMANN, *Involutina sinuosa sinuosa* (WEYNSCHENK), *Turrispirillina carpatho-rumana* TURCULEŢ, *Vidalina martana* FARINACCI, *Variostoma cochlea* KRISTAN-TOLLMANN, *Diplotremina astrofrimbriata* KRISTAN-TOLLMANN etc.;
- over thirty ammonite species: *Halorites alexandri* (MOJSISOVICS), *Tragorhacoceras occultum* (MOJSISOVICS), *Megaphyllites insectus* MOJSISOVICS, *Placites polydactyluS* (MOJSISOVICS), *P. oxyphyllus* (MOJSISOVICS), *P. symmetricus* (MOJSISOVICS), *Arcestes (Stenarcestes) hermocratis* GEMMELLARO, *A. (Arcestes) didymus* MOJSISOVICS, *A. (A.) agnatus* MOJSISOVICS, *A. (A.) syngonus* MOJSISOVICS, *Catenohalorites* aff. *pygmaeus* (DIENER);
- nautiloids: *Grypoceras mesodicum* (QUENSTEDT), *G. mesodicum subsulcatum* TURCUEŢ, *Gonionautilus securis* (DITTMAR), *Clydonautilus triadicus* MOJSISOVICS;
- over fifthteen species of brachiopods: *Halorelloidea* cf. *rectifrons* (BITTNER), *Euxinella pamirensis* DAGYS, *Mentzelia glabra* DAGYS, *Zugmayerella koessenensis* (ZUGMAYER), *Majkopella* cf. *worobievi* (MOISEEV), *Oxycolpella oxycolpos* (EMMRICH), *O. robinsoni* DAGYS, *O. kunensis* DAGYS, *Triadithyris gregariaformis* (ZUGMAYER) etc.;
- bivalves: *Monotis haueri* KITTL, *Monotis haueri semistriatus* TURCULEŢ, *Monotis* sp .

The Himalayan influences are indicated by *Paratibetites carpathicus* TURCULEŢ and also *Thisbites* sp. (ex. gr. *T. meleagri* MOJSISOVICS), *Himavatites?* sp. (aff. *H. watsoni* (DIENER), *Trachyphyllites* sp. (Turculeţ, 2000).

Reason for protection: The uniqness and the richness (from the paleontological point of view) of the klippe.

Present stage of protection: As we mentioned above, the klippe was partially exploited; now it is undergoing quick degradation, and the rocks are almost entirely covered by grass.

Protection measures: The identification through a panel and a protective fence would be the first measures.

Historical approach: The fossil fauna revealed its significance during the last decades, when Turculeț (1971, 1972, 1976 b, 1983, 1986, 1999, 2004a) published several papers about it.

Collections: The fossil material is held in the "Paleontology-Stratigraphy" Museum of original specimens of the Department of Geology within the "Alexandru Ioan Cuza" University of Iaşi.

4. The Rhetian klippe of Măgura hill (Pojorâta)

Type of protected area: natural monument. Category: IUCN III. Surface: 0.5 ha.

Geo-tectonical Unit: Median Dacides, Transylvanian Nappes.

Lithostratigraphy: Grey massive limestones built a block of small dimensions (2 m/1.5 m) which appears in the Cretaceous Wildflisch.

Access: The klippe is situated near the scientific reservation of "*Aptychus* strata*"* (Pojorâta – Câmpulung Moldovenesc driveway); after one crosses the railway and meets a small spring, one must climb the right pathway (250-300 m) until one reaches the route which goes over the Northern part of Măgura hill; the klippe can be found on the brink of the route.

Scientific arguments: The Rhetian fauna with *Rhaetina gregaris* (SUES), *R. pyriformis* (SUESS), *Waldheimia elliptica* (ZUGMAYER), *Z. norica* (SUESS), *Fissirhynchia fissicostata* (SUESS), *Triadithyris gregariformis* (ZUGMAYER), *Zugmayerella koessenensis* (ZUGMAYER), *Austrirhynchia cornigera* (SCHFHÄUTL), *Euxinella pamirensis* DAGYS. This fauna, and also the lithology, has several affinities with the so-called Koessen facies from the Alps.

Reason for protection: The klippe is unique through its fauna in the Eastern and Southern Carpathians. The other similar blocks which were signaled in the Rarău Syncline have smaller dimensions and they cannot be protected by law.

Present stage of protection: Because the block appears in the proximity of the route, and in the next years could even intefere with its trajectory, destruction is almost certain in the future.

Protection measures: The deviation of the route is absolutely necessary. A fence and an identification panel are also indicated.

Historical approach: The block is known since the beginning of the XX-th century, when Merhart (1910) described several species of brachiopods. Consequently, many brachiopod and bivalve taxa were quoted by Turculeț (1971, 2004 a).

Collections: The brachiopod fauna of the Rhetian klippe described by Turculeț (1971, 2004a) is held in the "Paleontology-Stratigraphy" Museum of original specimens of the Department of Geology within the "Alexandru Ioan Cuza" University of Iaşi.

Proposal for the establishment of the Rarău National Geopark

In June 2000, four geoparks (Reserve Geologique de Haute-Provence – France, **N**atural History Museum of Lesvos Petrified Forest - (Island of Lesvos) Greece, Geopark

Gerolstein/Vulkaneifel - Germany and Maestrazgo Cultural Park – Spain) established The European Geoparks Network (www.europeangeoparks.org). Today, there are 35 geoparks from 13 countries, Haţeg Country Dinosaurs being one of them.

The area of the Massif of Rarău meets the main criteria for a new geopark, respectively geodiversity, biodiversity and socio-cultural heritage.

The cristalline basement, the autochthonous sedimentary cover (Mesozoic in age), and also several sedimentary and volcanics klippen of the allochthonous Transylvanian Nappes can be encountered in the area. The varied geology on a relatively small surface (2750 ha), along with the attractive landscape, generated scientific and educational interest, several sites already being important nature reserves (Pietrele Doamnei, Piatra Şoimului, Rarău Peak, Peşterea Liliecilor, Moara Dracului).

The geodiversity engendered the various habitats (from the dominant forests with the *Picea abies* to the alpine and boreal meadows, and also rocky slopes, calcareous and cristalline detritus with specific vegetation). The secular forest of Slătioara is one of the most important natural reservations of this area. Diverse native plants, some invertebrates and also vertebrates can be encountered in these habitats, several of them being of particular interest (Order 92/43 CEE/12 May 1992, stipulating the protection of natural habitats and of flora and fauna species): *Hamatocaulis vernicosus* (MITTEN) HEDENÄS, *Asplenium adulterinum* MILDE, *Campanula serrata* (KIT. ex SCHULT.) HENDRYCH, *Carabus variolosus* FABRICIUS, *Barbastella barbastellus* SCHREBER, *Triturus cristatus* LAURENTI etc. Biologists already undertook many-sided studies to record the variety of habitats and organisms, aiming at their conservation and protection as the Rarău-Gimalău National Park ROSCI0212 (natura2000sv.com).

The socio-cultural heritage presents interesting aspects such as a lot of historical myths reflected in the toponymy (Rarău, Pietrele Doamnei - The Lady's Stones, Peştera Liliecilor – The Cave of the Bats, Piatra Buhii – The Stone of the Owl etc.); a special kind of manufacture of wood (padlocks, tools, plates and dishes etc. – the Museum of Wood in Câmpulung Moldovenesc), special folk costumes and folklore, other local customs etc.

The area has already aroused significant touristic interest and the administrative and cultural authorities are willing to become involved in the promotion and protection of the local values, in all respects.

In conclusion, we reinforce the proposal for the establishment of the Rarău Geopark with an area of 2750 ha and for the beginning of the procedures necessary for it to join the European Geoparks Network.

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