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REVIEWS AND DISCUSSIONS

Comments on the Paper "Berriasian Ammonites of Supposed Tethyan Origin from the Type "Ryazanian", Russia: a Systematic Re-Interpretation" (Frau et al., 2021)

V. V. Mitta[a, b, *]

[a] *Borissiak Paleontological Institute, Russian Academy of Sciences, Moscow, 117647 Russia*
[b] *Cherepovets State University, Cherepovets, 162600 Russia*
**e-mail: mitta@paleo.ru*

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Abstract—A paper revising the taxonomy of ammonites of Tethyan origin from the Ryazanian (=Berriasian) Stage of the Russian Platform and adjacent regions is critically examined.

Keywords: Ammonoidea, Perisphinctoidea, Lower Cretaceous, Ryazanian, Berriasian, Russian Platform
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INTRODUCTION

Recently, a team of researchers from different countries and institutions—C. Frau (Toulon, France), W.A.P. Wimbledon (Bristol, UK), C. Ifrim (Heidelberg, Germany), L.G. Bulot (Marseille, France) and A. Pohl (Dijon, France), published a large paper with a revision of the taxonomy of the Central Russian ammonites of the Ryazanian Stage "presumably", as its title suggests, of Tethyan origin (Frau et al., 2021). For the most part, this is a critical analysis of my publications on ammonites of the Ryazanian age, from 2002 to 2018 inclusive. The authors have given a fairly complete list of these papers, published mainly in the Paleontological Journal. Numerous reproductions are given, mostly from my publications, as well as photographs of some types from monographs by previous researchers (Bogoslowsky, 1896; Luppov et al., 1988). The authors note that the revision was based on literature data, without studying the ammonites themselves.

Unfortunately, the work under discussion contains numerous errors and shortcomings. Most of the reproductions of photographs of ammonites in Figs. 2, 6, 8 are shown on a distorted scale, while the internal whorls of *Transcaspiites* in Figs. 7D, 7E are shown with a twofold increase, without indicating it; there is no reference to the source of this specimen (Mitta, 2007, pl. 3, figs. 1a, 1b).

Figs. 5A, 5B show a reproduction of *Riasanites rulevae* (Mitta) (Mitta, 2007, pl. 3, figs. 7a, 7b), but *Prorjasanites plumatus* Sasonova (Sazonova, 1977, pl. 19, fig. 3) is indicated in the figure caption. An actual image of the *Prorjasanites plumatus* is reproduced in Figs. 5C–5E, erroneous labelled as *P. vnigni* Sasonova (Sasonova, 1977, pl. 20, fig. 4).

Figures 6A, 6B show two different specimens (holotype and paratype) of *Mazenoticeras robustum* Mitta indicated as holotype; the reproduction in Fig. 6B does not indicate the source (Mitta, 2011b, pl. 6, fig. 4).

The lectotype of *Riasanites rjasanensis* (Nikitin) is housed at the Mining Museum of St. Petersburg (Mitta, 2008, p. 256), not at the Research Geological Institute (VSEGEI) as stated by Frau et al. (2021, p. 523).

To illustrate the distinguishing characters of the genus *Transcaspiites*, Frau et al. (2021, Figs. 7H, 7J) cited an incorrect scale, exceeding the actual shell size by ~25% cited reproductions of photographs of the holotype of its type species *Protacanthodiscus transcaspius* Luppov (*Atlas* ..., 1949, pl. 64, fig. 4), heavily retouched in the original. A more correct image of the holotype (and of the species as a whole) is provided by later photographs (Bogdanova et al., 1985, pl. 6, figs. 5, 6a; Luppov et al., 1988, pl. 14, fig. 2[1]; Arkadiev et al., 2012, pl. 29, fig. 11). Colleagues demonstrate an inventive vision of geography and paleogeography. The list of species of "eastern Mediterranean–Caucasian" origin includes Mediterranean taxa, and the species from the North Caucasus and Mangyshlak are listed as "western Mediterranean–Caucasian origin" (Frau et al., 2021, p. 516).

[1] In two these publications (Bogdanova et al., 1985; Luppov et al., 1988), edited for publication after the death of N.P. Luppov (1904–1975) on the basis of his manuscripts, some references to figures and their numbering in photo plates are mixed up.

When discussing the Central Russian and Mangyshlak species, which I treat in the genera *Subalpinites* Mazenot (the type of the genus is described from France) and *Karasyazites* Mitta (the type of the genus is described from Mangyshlak) (tentatively assigned by Frau et al. (2021) to the latter), they say "...supposed affinities between the Trans-Caucasian and Mediterranean forms..." (ibid., p. 530). I hope that this is a misprint, since Mangyshlak (Caspian region, Kazakhstan) is not in Transcaucasia (South Caucasus). Regrettably Frau et al. (2021) cite the zonal subdivision of the Ryazanian Stage according to Mitta (2017), when the revised version of their manuscript was submitted in mid-2020, so it would have been quite possible to take into account the revised version of the zonal scheme (Mitta, 2019a, b). The subdivision of the Ryazanian Stage in its type region (Russian Platform) is also substantiated in a later paper, when characterizing the zonal index species of this interval (Mitta, 2021).

Frau et al. (2021) complain that "...some of the generic identifications have been repeatedly revised (compare systematic treatement [sic] between Mitta, 2002 and Mitta, 2018 for example)" (Frau et al., 2021, p. 516). It is probably appropriate refer to their own publication, where *Riasanites*? sp. was listed from the Tithonian of France? (Wimbledon et al., 2013, text-fig. 12). Just a year later, this specimen (a deformed shell less than 45 mm in diameter, represented by only two-thirds of one whorl, without internal whorls, in fact, Perisphinctoidea indet.) became the holotype of a new species *elsae*, which became the type for the new monotypic genus *Pratumidiscus* (Bulot et al., 2014, text-fig. 6). I think it is quite natural that I revise my earlier definitions with increasing material and knowledge, especially over decades of research.

My first collections of ammonites of the Ryazanian Stage date back to 1980, and only 20 years later, the processing of the accumulated material began, which lasted for another two decades. The identifications in the first article describing the Ryazanian ammonites of Tethyan origin (Mitta, 2002) were made mainly based on published data.

In subsequent years, I had the opportunity to study the collections of Berriasian ammonites of South-East France, housed in the University of Lyon, Claude Bernard, the Museum of Natural History in Paris, as well as the raw collections of the Sorbonne, housed in the collections of the University of Pierre and Marie Curie in Paris, and with ammonites of the same age in many other institutions in Western and Eastern Europe. This allowed more confident determination of the systematic affiliation of the Central Russian ammonites, which included revising our earlier identifications.

Frau et al. (2021) consider the two oldest species identified in the Ryazanian, *Riasanites rjasanensis* and *R. swistowianus*, as one "palaeospecies" (Frau et al., 2021, p. 520). It is difficult to say what the authors understand by the term "palaeospecies" in paleontological work, perhaps this is some kind of analogue of biospecies in ammonites in the understanding of J.-H. Callomon (Callomon, 1985). However, since the time of their publication (Nikitin, 1888), the two species indicated above have been accepted as independent by several generations of specialists who have seen the actual material, and not only judged it from the images. Illustrations by Frau et al. (2021, text-fig. 2) demonstrate the differences between these two species, which are quite obvious to any specialist in ammonites, both in terms of the degree of whorl overlap and differences in ornamentation.

Frau et al. (2021) indicate that "*R. rjasanensis* is thereafter retained as the senior name by pagination priority in the work of Nikitin (1888) and its wide use in the literature" (Frau et al., 2021, p. 520), i.e., that *R. rjasanensis* is the senior synonym based on page priority in S.N. Nikitin (1888) and widely used in the literature. The reference to 'page priority' is erroneous as it is excluded from the current edition of the Code (*International Code*..., 1999). This could probably be an incidence of the use of the First Reviser rule (*International Code*..., 1999, Art. 24.2), but it was not cited as such.

Frau (2021, p. 522) write: "Luppov's specimen is a whorl fragment of a Riasanitidae that lack diagnostic features. As such, we therein consider *R. bogoslowskii* as invalid with respect to the ICZN Code". It is not clear from this statement how poor preservation of a specimen without diagnostic characters could affect code validity (it cannot). In fact, Mitta (2018) established that *R. bogoslowskii* Luppov in Luppov et al., 1988 is a junior synonym of *Karasyazites bajarunasi* (Luppov in Luppov et al., 1988).

Species established in the genus *Riasanella: R. riasanitoides, R. plana, R. rausingi, R. olorizi* (Mitta, 2011a), are reduced by Frau et al. (2021) to synonyms of the type species, *R. rausingi*, primarily due to their origin from one narrow interval (condensed deposits) of one locality (Frau et al., 2021, p. 523). At the same time, they recognize the independence of all *Subalpinites* species found in the same interval of the same locality: *S. krischtafowitschi, S. gruendeli, S. faurieformis,* and *S. remaneiformis* (Mitta, 2009b). This selective approach is probably explained by different shell dimensions: *Riasanella* macroconchs are comparable in size to *Subalpinites* microconchs, and it was easier for opponents to see their obvious differences from images of the large-sized macroconch shells of the latter.

Frau et al. (2021) considered *Transcaspiites tscheffkini* (Mitta, 2018) to be a junior synonym of *"Hoplites" micheicus* Bogoslowsky, which they assigned to the genus *Mittaites*. The paper under discussion contains photographs of the holotype of the Bogoslowsky species (Frau et al., 2021, text-figs. 7A–7C), taken with-

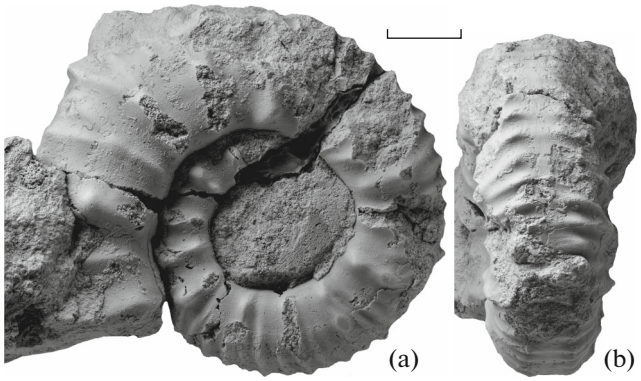

Fig. 1. *Transcaspiites micheicus* (Bogoslowsky, 1896), holotype (by monotypy), F.N. Tchernyshev Central Research Geological Exploration Museum (TsNIGR Museum, St. Petersburg), no. 63/623, phragmocone: (a) lateral view, (b) ventral view; Ryazan Region, Sapozhkovsky District, riverbank of the Pozhva River, near the village of Mikhei; Ryazanian Stage, *Spasskensis* Zone. Scale bar 10 mm; photographs by S.V. Bagirov (PIN RAS).

out coating and partially cropped in Photoshop (which does not give the reader the opportunity to fully visually compare these two species), so I think it is necessary to publish new photographs (Fig. 1). It should be noted that, except for a few individual cases, the drawings in the work of N.A. Bogoslowsky (1896) are quite accurate and much more informative than the photographs provided by Frau et al. (2021).

It is possible to shuffle species endlessly among different closely related genera; it seems to the author that this is of no practical importance, especially given the well-known subjectivity of understanding paleontological species. However, in the work under discussion, without revision of the genus-group taxa, on the basis of type material originating mainly from the Berriasian of SE France, it is denied that a number of species of clearly Tethyan origin in fact were Tethyan not only in the Eastern European (Central Russia and Poland), but also in the Crimean-Caucasian paleobiogeographic provinces.

Frau et al. (2021) propose a new family, Riasanitidae, which includes the genera *Gechiceras* Sakharov, *Tauricoceras* Kvantaliani et Lyssenko (=*Subriasanites* Sazonova), *Riasanites* Spath, *Riasanella* Mitta, *Prorjasanites* Sazonova, and the new genus *Mittaites* Frau et al.

The idea of separating the *Riasanites* and related genera into a taxon of family rank has long been "in the air". Several decades ago, in a paper on new species of Crimean *Tauricoceras*, exclusively in the English abstract, without any mention in the text, it was stated: "A new subfamily Riasanitinae Kvantaliani et Lysenko is recognized as the family Berriasellidae Spath" (Kvantaliani and Lysenko, 1982, p. 8). According to the Code (*International Code...*, 1999) this name is a nomen nudum. I believe that Soviet researchers declined to establish this taxon due to the unclear origin and phylogenetic relationships of *Riasanites* and related ammonites. The situation is no clearer at the time of writing of Frau et al. (2021).

The authors included both North Caucasian taxa (*Gechiceras*) and Crimean taxa (*Tauricoceras*) in the new family Riasanitidae. In this case, the range of Riasanitidae covered the water area of at least two paleobiogeographic provinces (East European and Crimean-Caucasian) belonging to different superrealms (Boreal and Tethyan, respectively). Therefore, this does not fit the definition of the range of Riasanitidae as a "restricted palaeobiogeographic distribution" (Frau et al., 2021, p. 515).

When discussing the new genus *Mittaites*, Frau et al., refer to it as related to *Mazenoticeras*: "... the type species *Mazenoticeras broussei* (Mazenot, 1939) differs distinctly from the Russian relatives..." (Frau et al., 2021, p. 526). An explanation of the illustration with reproductions of specimens assigned by me to the genus *Mazenoticeras*, and by Frau et al. to *Mittaites*, begins with the words "Re-illustration of *Malbosiceras* relatives ..." (Frau et al., 2021, fig. 6). Given that the genera *Malbosiceras* Grigorieva and *Mazenoticeras* Nikolov belong to the family Neocomitidae, then taxa related to them (whatever they are called), would be more logically assigned to the same family.

Frau et al. (2021, p. 530) doubt whether *Dalmasiceras,* described from the Caucasus (Khimshiashvili, 1976; Kvantaliani, 1999) and from the Crimea (Bogdanova and Arkadiev, 1999) belong to this genus, "...since they only superficially match the type species *D. dalmasi*". However, we can distinguish paleontological species only by external features, and different species of the same genus must have both similarities (in terms of generic rank) and differences (species rank). The similarities and differences between the French and Crimean *Dalmasiceras* were discussed by the author in 2004 with the late F. Cecca, researcher of the Tithonian and Berriasian ammonites of France, and we came to the unanimous conclusion that some species identified by T.N. Bogdanova and V.V. Arkadiev, are very close or even identical to the French ones. I should add that two new species of *Subalpinites* described from the Crimean Mountains (Arkadiev et al., 2012) are very close to some Central Russian species assigned (Mitta, 2009b) to the same genus.

It is striking that Frau et al. (2021) compare the Central Russian and Crimean species exclusively with the type species of the genera. Yes, of course, there will be differences here, this is always the case between species of the same genus.

The article by Frau et al. (2021) seeks to cast doubt on the Tethyan origin of the ammonites discussed (as is indicated in its title and repeatedly postulated in the text). An inexperienced reader could be persuaded, as a result, to be wary of the correlation of the Ryazanian deposits with the Berriasian sections of the type area

(Frau et al., 2021, p. 534). Indeed, 40 years ago, with insufficient knowledge of the diversity and taxonomic composition of ammonites of the Ryazanian Stage, there were doubts about the correctness of the assumptions about the Tethyan origin of some of them (Donovan et al., 1981, p. 154). However, the material obtained over the past two decades has dispelled all doubts.

Back in the 19th century N.P. Vischniakoff (1878) excellently illustrated, using Central Russian material, the fact that the ammonites of the Volgian Age had completely atrophied specific apertural outgrowths (lappets), observed in the microconchs of most Jurassic ammonites, including Perisphinctoidea. Lappets are absent in the undoubted Volgian perisphinctoids (representatives of the families Virgatitidae and Dorsoplanitidae, and in the descendants of the latter, the family Craspeditidae). Craspeditids absolutely dominate in the upper substage of the Volgian Stage and the Ryazanian Stage of the boreal regions; the shells of their microconchs have apertural margins with weakly expressed ventral and lateral projections, but without lappets (Gerasimov, 1969; Mitta, 1993, 2010; and others). At the same time, the Tithonian/Berriasian Perisphinctoidea of the Tethyan (Tethys-Panthalassa) Superrealm retained well-defined lappets, both in the Mediterranean paleobiogeographic Province and in the Crimean-Caucasian Province (Retowski, 1893; Mazenot, 1939; Khimshiashvili, 1976; etc.).

Despite the unfavorable depositional settings of condensed deposits and the rarity of well-preserved ammonites, several specimens of eared microconchs are known from the Ryazanian Stage of the Russian Platform; one of them is depicted, a *Mazenoticeras* shell with a well-preserved lappet (Mitta, 2011b, text-fig. 4). Such finds irrefutably testify to the Tethyan origin of some of the Ryazanian ammonites. However, this is actually confirmed by Frau et al. (2021), declaring the wide distribution of the species *Riasanites rjasanensis* (Nikitin), the range of which, according to the synonymy given by them, occupied vast water areas not only of Central Russia and the Polish Lowland, but also of the undoubted periphery of the Tethys, the Southern and Northern Caucasus and Mangyshlak.

However, the tone of the paper strongly suggests that the authors recognize a true Tethyan origin only for the taxa of the marginal western part of the Tethys, referred to as the Mediterranean province. The errors in modern geography in the paper may be attributed to misprints, but Frau et al. (2021) show a limited understanding of the pre-Cretaceous paleogeography of the Northern Hemisphere. Five or six stages before the Berriasian, in the late Bajocian (Middle Jurassic), the northwestern margin of the Tethys in the south of the territory under discussion was within the paleobasins of the Caucasus and Pericaspian. In the north up it extended to the central part of the Russian Platform, from the Middle Volga Region in the east to the Donets Basin in the west (including here the basin of the Oka River, a typical area of the Ryazanian Stage).

Studies of the last two decades have made it possible to establish the Boreal-Tethyan ecotone at the turn of the Bajocian and Bathonian in the Volga River region, in the vicinity of Saratov. As a result, thanks to finds in the same section of high-latitude boreal *Arcticoceras* (family Cardioceratidae) and Peri-Tethyan *Oraniceras* (family Parkinsoniidae), it was possible for the first time to compare a part of the "boreal Bathonian" (Callomon, 1985) with the standard Western European scale of the Bajocian and Bathonian (Mitta and Seltzer, 2002; Mitta, 2009a; Mitta et al., 2011, 2014, 2015).

Events of various kinds repeat themselves, not only in human history, but also in geological history. The emergence of the Boreal-Tethyan ecotone on the territory of present-day Central Russia at the turn of the Jurassic and Cretaceous, as a kind of repetition of events at the Bajocian–Bathonian boundary, I consider to be natural, based on the geological structure and tectonics of the Russian Platform and adjacent territories of the northwestern Tethys. The difference in the occurrence of these Boreal-Tethyan ecotones is only in the direction of transgression: at the beginning of the Bathonian, the invasion of ammonites occurred from north to south, and at the beginning of the Berriasian, in the opposite direction.

I believe that at present the (undoubtedly) Tethyan ammonites of the Ryazanian Stage of the Russian Platform are the only reliable tool for correlating host deposits with units of the Berriasian Stage of the Mediterranean Province.

The attempt made by K. Frau et al. (2021) to revise the taxonomic composition of Berriasian/Ryazanian ammonites of Tethyan origin in the East European and partly Crimean–Caucasian paleobiogeographic provinces is interesting, but not entirely successful. Their work would have been improved by careful study of the collections of ammonites available in the museums of Moscow and St. Petersburg; this would have made their conclusions much more substantiated and justified.

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