VOLUMINA JURASSICA, 2018, XVI: 189–194

Comments on "New aragonite $^{87}Sr/^{86}Sr$ records of Mesozoic ammonoids and approach to the problem of N, O, C and Sr isotope cycles in the evolution of the Earth" by Yuri D. Zakharov, Sergei I. Dril, Yasunari Shigeta, Alexander M. Popov, Eugenij Y. Baraboshkin, Irina A. Michailova and Peter P. Safronov [*Sedimentary Geology*, 364 (2018): 1–13]

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Key words: ammonoids, Sr isotopes, erroneous determination.

Abstract. Comments are provided on a published paper on $^{87}Sr/^{86}Sr$ records of Mesozoic ammonoids [Yuri D. Zakharov, Sergei I. Dril, Yasunari Shigeta, Alexander M. Popov, Eugenij Y. Baraboshkin, Irina A. Michailova, and Peter P. Safronov, New aragonite $^{87}Sr/^{86}Sr$ records of Mesozoic ammonoids and approach to the problem of N, O, C and Sr isotope cycles in the evolution of the Earth, *Sedimentary Geology*, 364 (2018): 1–13], where insufficiently or erroneously dated materials have been used. The names of the Jurassic ammonites used in the discussed article are erroneous, and these names are sometimes allocated wrong stratigraphic and geographic information. For example, "*Procerites funatus*" from the Callovian of the Ryazan region following its features and mode of preservation should be re-assigned to the Volgian *Kachpurites cheremkhensis* from the Yaroslavl area. These problems partly result from the study of specimens delivered from fossil dealers. Therefore, the interpretation of the differences in Lower Albian ammonite Sr isotope values as function of their habitat depths given by these authors should rather be explained by their different geologic age.

Due to the significant oscillation of Sr isotope values in marine carbonates through time and the uniformity of the strontium isotope compositions of different basins, Sr-isotope chemostratigraphy provides a powerful tool for correlation. The Jurassic and Cretaceous parts of the Mesozoic Sr isotope curve are generally produced using Sr isotope data derived from the calcite shells of mollusks, primarily belemnites and bivalves, and in a few cases also brachiopods (McArthur *et al.*, 2012). However, the Sr isotope composition of ammonite shells is still insufficiently known, as most studies dealing with aragonite from ammonite shells have been focused on the Upper Cretaceous (McArthur *et al.*, 1994; Cochran *et al.*, 2003) and rarely on other stratigraphic intervals (Wierzbowski *et al.*, 2012). From this point of view the new data presented by Zakharov *et al.* (2018) may be useful. However, the samples used for stratigraphical and/or environmental studies should invariably be precisely dated, otherwise their interpretation becomes very doubtful. Especially good results can be derived from the analysis of well-dated fossil successions providing information on short-time events. Unfortunately, this is not a case of the discussed article.

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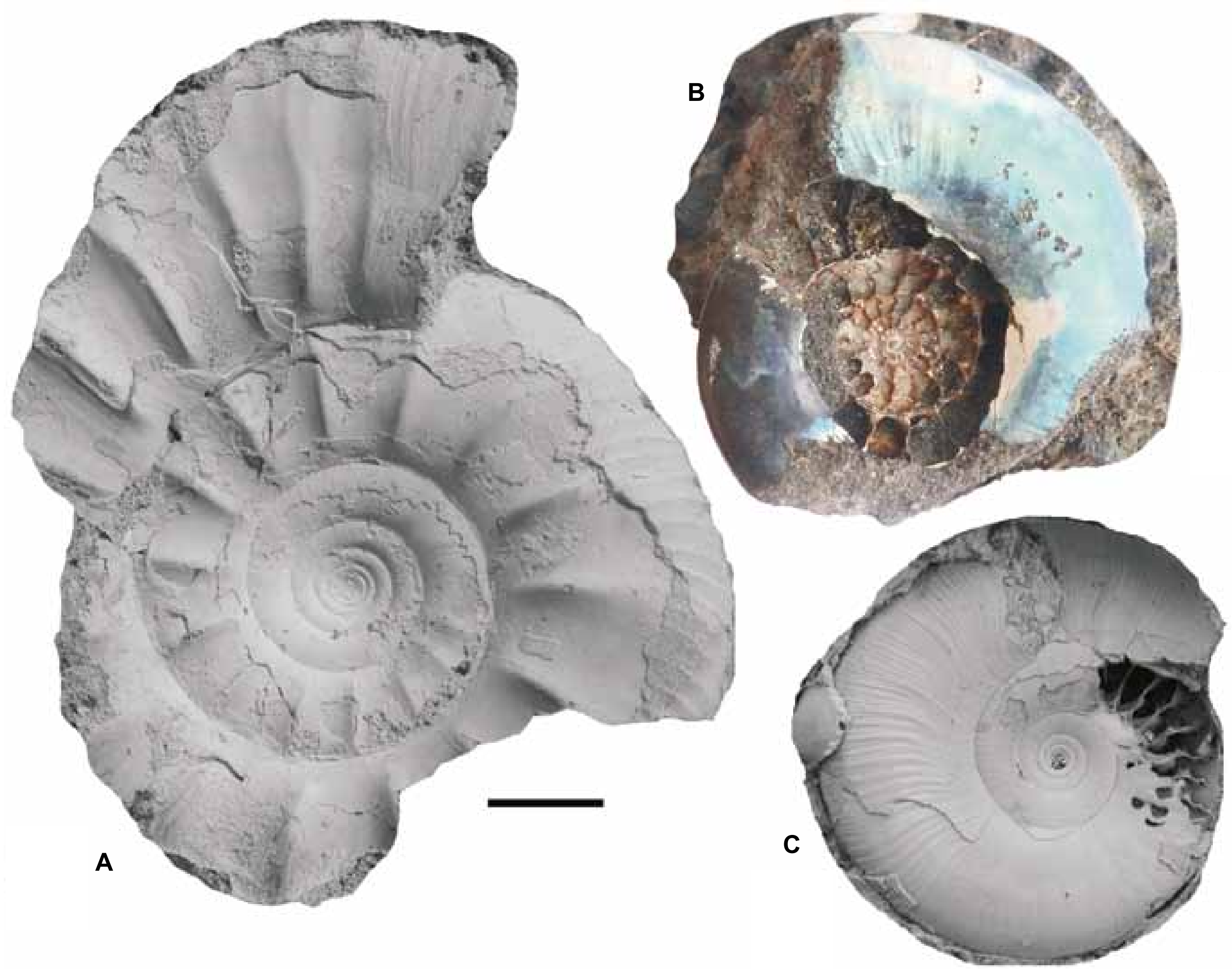

Fig. 1. *Kachpurites cheremkhensis* Mitta, Mikhailova et Sumin, 1999.
Upper Jurassic, Upper Volgian, Fulgens Zone, *cheremkhensis* horizon, from Ivanovskoe, Yaroslavl area

A. Coarsely-ribbed morphotype, specimen MK4509; **B.** Specimen MK6127, bed 1a, base of the Upper Volgian; **C.** Typical morphotype, specimen MK4350. The specimens figured in 1A and 1C were coated with ammonium chloride. Scale bar = 1 cm

Although most of the authors (Zakharov, Baraboshkin and Michailova) are professional ammonitologists and stratigraphers, erroneous ammonite names and unclear stratigraphy are common features of this paper, *e.g.*, all the names of the Jurassic ammonites mentioned in this paper are erroneous:

Hildaites serpentinum Buckman (Zakharov *et al.*, 2018: p. 6, fig. 3.3) – this is a chimaerous name mixing *Harpoceras serpentinum* (Schlotheim, 1813) and *Hildaites subserpentinum* Buckman, 1921 (the latter is the type species of the genus *Hildaites*, *cf.* Howarth, 2013). The figured specimen, collected by Y.D. Zakharov, comes from the famous locality of Mount Teysachaux, which is known as a source of numerous Toarcian fossils (Hug, 1898). The preservation of the figured specimen is relatively poor. It resembles *Hildaites subserpentinus* Buckman, but rather should be ascribed to as *Hildaites* sp.

The next ammonite is *Harpoceras falciferum* Sowerby (Zakharov *et al.*, 2018: p. 6). As J. Sowerby (1821) included this species in the genus *Ammonites* (*A. falcifer* – Sowerby, 1821: p. 99, pl. CCLIV, fig. 2), its correct name should be *Harpoceras falciferum* (J. Sowerby). This specimen also was collected by Y.D. Zakharov from the same locality as the previous species.

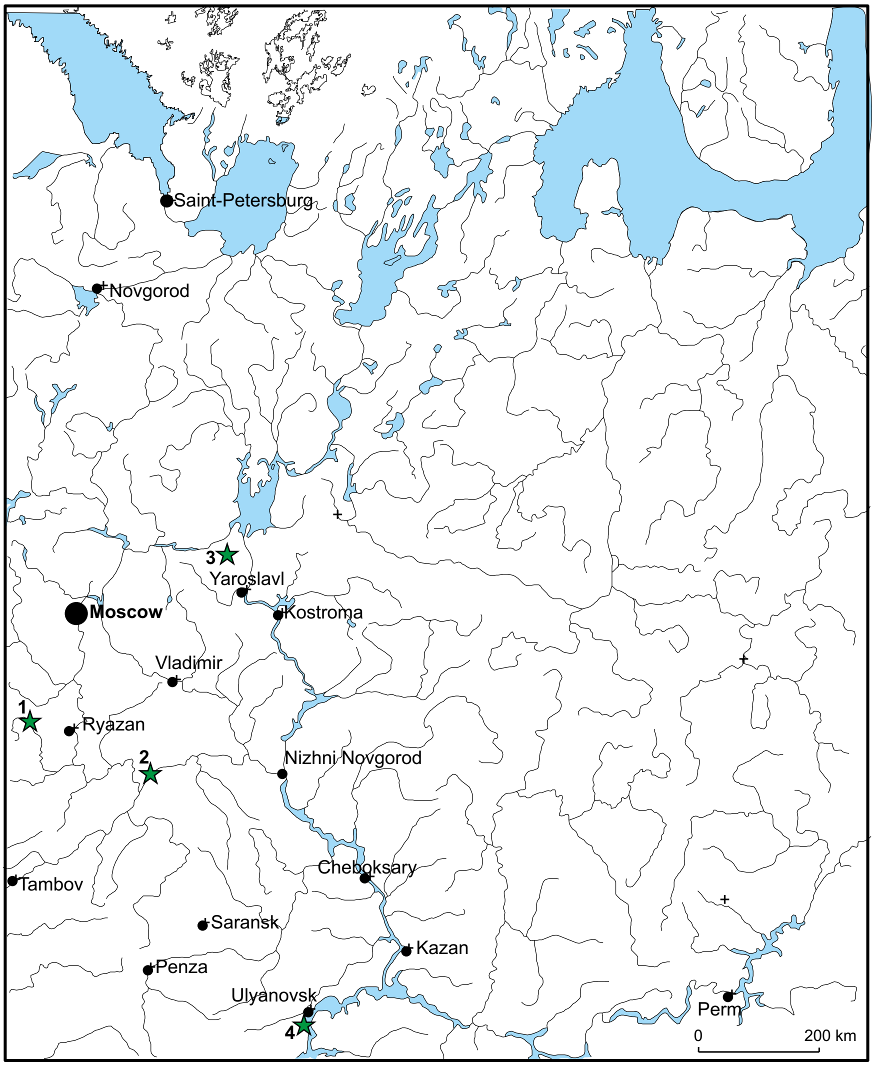

Fig. 2. Map showing mentioned localities of the Russian Platform

1 – Mikhaylov; 2 – Elatma; 3 – Ivanovskoe; 4 – Kriushi

Another Jurassic ammonite is *Procerites funatus* Oppel from the Elatma river, Ryazan area (lower Upper Callovian) (Zakharov *et al.*, 2018: p. 6, fig. 3.2). Its name and description comprise a mixture of an erroneous name, wrong locality and age. The ammonite genus *Procerites* is restricted to the Bathonian, and it is entirely unknown from the Russian Platform. The Callovian species described by A. Oppel as *Ammonites funatus* is now considered to belong to the genus *Homoeoplanulites* (Mangold, 1970; Schlegelmilch, 1985), but *Homoeoplanulites funatus* (Oppel, 1863) is restricted to the latest Early Callovian. In addition, this species is unknown from the Callovian of the Russian Platform. There are no ‘Elatma river’ outcrops, but the Callovian locality near the village of Elatma belongs to the classical localities of the Callovian of European Russia (Nikitin, 1881, 1885; Kiselev, 2001). Ammonites from the Lower-Middle Callovian boundary beds occur here as marlstone moulds, which is entirely different from the mode of preservation of the specimen ascribed by Zakharov *et al.* (2018) to funatus species. This specimen is preserved as a mould in phosphorite sandstone showing a preserved nacreous layer. The morphological features of the figured specimen (very thin striae in the upper half of the flanks and nearly smooth whorls) strongly differ from those of Callovian *Homoeoplanulites* or related taxa. Both the mode of preservation and the morphology of the figured specimen are identical to Upper Volgian (=uppermost Tithonian) ammonites of the genus *Kachpurites* from the Ivanovskoe locality in the Yaroslavl area (Kiselev, Rogov, 2012), which is also known as a source of fossils traded by fossil dealers around the world. Because of the presence of the prominent striae the figured specimen should be determined as *Kachpurites cheremkhensis* Mitta, Mikhailova et Sumin, 1999, which is an index species of the *cheremkhensis* biohorizon of the Fulgens Zone (Rogov, 2017). A few specimens of *K. cheremkhensis* from the same locality are figured for comparison (Fig. 1). Significantly, the Sr isotope value measured in this specimen (0,707429) lies far from any Callovian datums but much closer to those derived from the Jurassic-Cretaceous boundary beds (see Wierzbowski *et al.*, 2017 for a reference).

Cosmoceras aculatum Michailov, lower Upper Callovian, from the Ryazan area (Zakharov *et al.*, 2018: p. 6) is also mentioned (previously this specimen has been mentioned as *Cosmoceras aculcatum* Michailow, see Zakharov *et al.*, 2006). Its name is a misprinting for *Gulielmiceras (Spinikosmoceras) aculeatum* (Eichwald, 1863), a common ammonite species, which occurs in the Middle-Upper Callovian boundary beds of the Russian Platform (Kiselev, 2001). Although a few decades ago the famous ammonitologist Nikolay P. Michailov worked on Jurassic ammonites of the Russian Platform and other Boreal areas, his studies were focused on the Kimmeridgian and Volgian Stages. Therefore, 'Michailov' within the trinomen *Cosmoceras aculatum* Michailov is, without a doubt, a misprint for the town of Mikhaylov (Ryazan area). A few quarries near this town yield rich and excellently-preserved, pyritized ammonites of Callovian–Oxfordian age. Since the early 90th years of the XX century these sections have been intensively explored by fossil hunters.

During the last few decades usage of fossil specimens bought from or donated by fossil dealers has become relatively common. However, such a practice leads to the correct interpretation only if the fossil dealers provide precise stratigraphic and geographic localization of the collected specimens (*cf.* Mikhailova, Baraboshkin, 2001) or when a locality is well-known, and the precise stratigraphic position is insignificant for the aims of the study (*cf.* Radtke, Keupp, 2017).

In the discussed article by Zakharov *et al.* (2018) Sr isotope values derived from several Lower Albian ammonites collected at Ambatolafia, Madagascar, are interpreted in terms of the relationship between the depth habitat of the ammonites and their Sr isotope signatures. These ammonites, which also are common fossils provided by fossil dealers, were collected without any stratigraphic control. As Zakharov *et al.* (2016) previously pointed out, the ammonoid fauna from the Ambatolafia locality belongs to the Cleoniceras besairiei and possibly Douvilleiceras inaequinodum zones. This conclusion is supported by checking the paper by Collignon (1963) in which ammonites from the aforementioned zones were figured from Ambatolafia. Taking into account the very long duration of the Albian, the differences within the Sr isotope values of different ammonites could be caused by variations in the geological age of the studied samples.

In addition to the comments on the paper by Zakharov *et al.* (2018) given above, inaccuracies in fields other than palaeontology and stratigraphy should be pointed out. A map showing 'location of investigated sites' (or, more correct, 'location of material sources' as some sites in fact were not visited and investigated by the authors of the discussed article) contains significant errors in the geographic position of some sites (Zakharov *et al.*, 2018: fig. 1). For example, the relative position of 'Ryazan area' and 'Ulyanovsk area' is incorrect (Fig. 2); Butte Creek in California is located more than 500 km north of point 11 in Zakharov *et al.* (2018). Point 9 "(Dorset, South West Englang [*i.e.* England] (uppermost Berriassian))" is not mentioned elsewhere in the text. As the Upper Berriasian of Dorset is represented by the non-marine Purbeckian facies (*cf.* Wimbledon, 2008), this is not very surprising. The enigmatic 'Kraushi' (see explanations to fig 2 in Zakharov *et al.*, 2018) is in fact an incorrect transliteration of Криуши (=Kriushi).

Finally, one trusts that Yury D. Zakharov and his co-authors will be more accurate in their further studies to avoid such errors as those commented above.

Hubert Wierzbowski and John Wright are warmly thanked for language correction. This study has been carried out following the plans of the scientific research of the Geological Institute of RAS (project no 0135-2018-0035).

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