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Revisiting the Early Jurassic (Sinemurian) brachiopod fauna from Smokovac, Montenegro

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The brachiopod fauna from Smokovac, near Risan, was originally described during the nineteenth century and contains species referred to the rhynchonellide genus *Rhynchonellina* Gemmellaro. Smokovac is within the Ledenica anticline, part of the Dinaric Carbonate Platform in the region of the Gulf of Boka Kotorska, Montenegro.

Hauer (1868) was the first to mention the presence of brachiopods in the vicinity of Smokovac and commented on "very peculiar brachiopods" (Hauer 1868, p. 445). This could be a direct reference to the morphology of *Arzonellina stachei* (Bittner) or even smooth-shelled species of *Rhynchonellina* that were perhaps not yet familiar to geologists as the monograph by Gemmellaro (1871), establishing the genus, had not yet been published. Subsequently, brachiopods from Smokovac were described and figured by Eichenbau (1883), Böse (1894), Bittner (1895), Mihajlović (1955), and Bešić (1959).

Specimens that represent two brachiopod species have been prepared from a talus rockfall block collected by MĐ in the vicinity of Smokovac in 2010. The sample was collected from a Quaternary talus field derived from weathered and spalled rock originating from rock outcrops and cliffs at higher elevations. Several attempts to determine the original position of the block in the outcrop have failed so far. Investigation of one of these species has resulted in the discovery that it is a long-looped terebratellid brachiopod now referred to *Arzonellina stachei* (Bittner) and therefore not a representative of the rhynchonellide genus *Rhynchonellina*, to which Alexander Bittner (1895) had assigned it (Sandy et al. 2018, Sandy et al. in review). With hindsight, the unusual morphology of this species, including a straight hinge line, allows differentiation from species of *Rhynchonellina* with which *Arzonellina* may be considered homoeomorphic. Bittner (1895, p. 564) had also commented on his species *stachei* being "one of the most peculiar and most curious species in the genus".

The original hypothesis when starting to investigate the brachiopods from the talus block was that it probably contained a monospecific assemblage referable to *Rhynchonellina*; this proved to be incorrect when *Arzonellina* was discovered. However, specimens of *Rhynchonellina bilobata* Gemmellaro were also prepared from the block. *Rhynchonellina* belongs to the rhynchonellide Family Dimerellidae within the Superfamily Dimerelloidea (Manceñido et al. 2002) and this was of particular interest. Sandy (1995, 2010; and in Gischler et al. 2003) had considered that representatives of *Rhynchonellina* could be associates of cold-seep faunas or chemosynthetic environments. *Rhynchonellina* is considered to range from the Late Triassic (Norian) to Early Jurassic (Pliensbachian) and occurrences younger than Toarcian require confirmation (Manceñido and Owen in Manceñido et al. 2002). A Late Jurassic (Tithonian) homoeomorph of *Rhynchonellina bilobata* Gemmellaro, "*Rhynchonella*" *schucherti* Stanton is associated with cold-seep environments and has been referred to *Cooperrhynchia* by Sandy and Campbell (1994).

The lithology that the brachiopods were recovered from at Smokovac is a white sparry, crystalline limestone. Stable isotopes of carbon and oxygen were taken from micrite and cements; $\delta^{13}\text{C}$ values 2.3 to 2.6‰ and $\delta^{18}\text{O}$ values -1.7 to -0.9‰. These results indicate that the carbonate precipitated under "normal seawater conditions" and there is no indication of an association with hydrocarbon seepage on the sea floor.

The paleobiogeographic distribution of the genus *Rhynchonellina* is Tethyan (e.g., Ager 1959; Cicardi and Gaetani 1974); Vörös (1993) commented that *Rhynchonellina* was characteristic of Early Jurassic carbonate platforms. Ager et al. (1972) stated that the highest concentration of described

species of *Rhynchonellina* and *Sulcirostra* (species of which were originally included in *Rhynchonellina*) was in Dalmatia (Croatia and Montenegro) and Sicily. Cicardi and Gaetani (1974) commented on the concentration of *Rhynchonellina* species as western Tethyan (although they note there may be a “monographic burst” of species in this area; however, there appear to be fewer records elsewhere). Therefore, the Apulian Plate can be considered the area of highest diversity for *Rhynchonellina*. This distribution is mirrored by the co-occurring *Arzonellina* at Smokovac that, with only two known species, is restricted to the Apulian Plate. In terms of stratigraphic distribution, Cicardi and Gaetani (1974) consider the early and middle Early Jurassic (Hettangian – Pliensbachian) to be the height of species diversity for the genus *Rhynchonellina* and the subfamily Rhynchonellininae. Smokovac is unique in Montenegro as the only locality with such an Early Jurassic brachiopod assemblage.

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References

- Ager, D.V.A., 1959. The classification of the Mesozoic Rhynchonelloidea. *J. Paleont.* 33, 324-332, pl. 49.
- Ager, D.V.A., Childs, A., Pearson, D. A. B., 1972. The evolution of the Mesozoic Rhynchonellida. *Géobios* 5(2-3), 157-235.
- Bešić, Z., 1959. *Geologischer Führer durch die Volksrepublik Crna Gora*. Societe geologique du Montenegro, Titograd, 559 p. [In Serbian with German summary].
- Bittner, A., 1895. Über die gattung *Rhynchonellina* Gemm. *Jb. k. k. geol. Reichsanst.* 44(1894), 547-572.
- Böse, E., 1894. Monographie des genus *Rhynchonellina* Gemm. *Palaeontographica* 41(1-2), 49-80, pls. 6-7.
- Cicardi, M.G., Gaetani, M., 1974. Revisione delle Rhynchonellininae (Brachiopoda) del Liassico del Bacino Lombardo. *Riv. Ital. Paleont. Stratigr.* 80(3), 352-388, pls. 29-33.
- Eichenbaum, J., 1883. Die brachiopoden von Smokovac bei Risano in Dalmatien. *Jb. k. k. geol. Reichsanst.* 33, 713-720.
- Gemmellaro, G. G., 1871. Studi paleontologici sulla fauna del calcare a *Terebratula janitor* del nord di Sicilia. Parte III. *G. Sci. Nat. Econom. Palermo* 7(1), 73-108[1-36], pls. 1-5.
- Gischler, E., Sandy, M. R., Peckmann, J., 2003. *Ibergirhynchia contraria* (F. A. Roemer), an Early Carboniferous seep-related brachiopod from the Harz Mountains, Germany – a possible successor to *Dzieduszyckia*. *J. Paleont.* 77, 293-303.
- Hauer, F. R. von, 1868. Geologische Uebersichtskarte der österreichischen Monarchie. Blatt X: Dalmatien. *Jb. k. k. geol. Reichsanst.* 18, 431-454.
- Manceñido, M., Owen, E. F., Savage, N. M., Dagys, A. S., 2002. Superfamily Dimerelloidea. In: Kaesler R. L. (Ed.). *Treatise on Invertebrate Paleontology. Part H. Brachiopoda (Revised), Volume 4, Rhynchonelliformea (part)*. Boulder (Colorado): Geological Society of America and University of Kansas Press, pp. 1236-1245.
- Mihajlović, M., 1955. Quelques especes Rhynchonellinae du calcaire jurassique a Smokovac pres de Risan (Boka Kotorska). *Geol. An. Balkan Poluost.* 23, 67-73. [In Serbian with French summary].
- Sandy, M. R., 1995. A review of some Palaeozoic and Mesozoic brachiopods as members of cold seep chemosynthetic communities: “unusual” palaeoecology and anomalous palaeobiogeographic patterns explained. *Földt. Közl.* 125(3 – 4), 241-258.
- Sandy, M. R., 2010. Brachiopods from ancient hydrocarbon seeps and hydrothermal vents, In: Kiel, S. (Ed.), *Topics in Geobiology: The Vent and Seep Biota*. Springer, Berlin, pp. 279-314 + Appendix 1, pp. 468-470, pls. 18, 19.
- Sandy, M. R., Radulović, B. V., Peckmann, J., Sulser, H., Radulović, V. J., Wu, S-Y., Đaković, M., 2018. Homeomorphy in an Early Jurassic rhynchonellide-dominated brachiopod coquina from Smokovac, Montenegro: an *incertae sedis* finds a home in the suborder Terebratellidina. *Geological Society of America, Abstracts with Programs*. Vol. 50, No. 6. doi: 10.1130/abs/2018AM-323189
- Sandy, M. R., Radulović, B. V., Sulser, H., Đaković, M., in review. New brachiopod family Arzonellinidae (Terebratulida) from the Early Jurassic (Sinemurian) of Montenegro, southern Europe, Mediterranean Province.
- Sandy, M. R., Campbell, K. A., 1994. New rhynchonellid genus from Tithonian (Upper Jurassic) cold seep deposits of California and its paleoenvironmental significance. *J. Paleont.* 68(6), 1243-1252.
- Vörös, A., 1993. Jurassic microplate movements and brachiopod migrations in the western part of the Tethys. *Palaeogeogr. Palaeoclimatol. Palaeoecol.* 100, 125-145.