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# Serpukhovian productid brachiopod buildups in the Carboniferous of Nötsch (Carinthia, Austria) – a response to rising sea level

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The Carboniferous of Nötsch, situated some 15 km west of Villach (Carinthia, southern Austria), is a small fault-bound Variscan slice at the southern margin of the Upper Austroalpine Drau Range, north of the Periadriatric line. In spite of extensive literature assembled during more than 200 years of research, unsolved, respectively controversely discussed topics include major issues like palaeogeographic rooting, depositional environment and even stratigraphic age of the formations from Nötsch.

The predominantly siliciclastic, more than 1000 m thick sedimentary succession consists of three formations, from below Erlachgraben Formation, Badstub Formation and Nötsch Formation. Published data on smaller foraminifers and calcareous algae indicate a Serpukhovian age of the complete succession. In the Jacomini Quarry, west of the road from Nötsch to Bleiberg, we studied the productid dominated facies of the "Zwischenschiefer", a shaly to marly to calcareous intercalation of about 15-20 m thickness within the upper third of the at least 350-400 m thick Badstub Formation, which consists of amphibolite-rich, polymictic breccias and conglomerates. The mostly dark gray "Zwischenschiefer" develops gradually from the breccia below by decrease of grain size and fading of clasts; gradual increase of grain size and renewed income of clasts is observed at the top of the horizon. The horizon consists of carbonate mudstone, bioclastic wackestone, packstone and floatstone yielding calcareous algae, smaller foraminifers, few rugose and tabulate corals, crinoid ossicles and rare gastropods, Most conspicuous, however, is the predominance of brachiopod shells which co-occur in very different sizes from millimetres to more than 160 mm in length and width. This coincides with the co-occurrence of shells of strongly varying thicknesses. In many cases articulated shells of strongly biconvex morphotypes are preserved. The abundance of brachiopod spines, in part still attached to the shell or abounding in immediate vicinity is most remarkable.

Macroscopic observation show that the brachiopods - the large ones preliminarily identified as *Semiplanella carinthica* Sarytcheva 1977 and *Latiproductus volgensis* Sarytcheva 1977 – are irregularily distributed. They form more than meter-sized agglomerates surrounded by fossil-poor sediments. Most probably all the big brachiopod-rich blocks removed by blasting from the quarry walls represent such agglomerates. Within the agglomerates, most brachiopods are orientated with their convex ventral valve downward, i.e. in life position. Smaller juveniles might nest within the shelter of the convex dorsal valve resulting in stapled growth of several individuals.

In conclusion, the co-occurrence of shells of different size and thickness, the occurrence of articulated shells, the astonishing abundance of brachiopod spines, and the existence of brachiopod agglomerates consisting of orientated, articulated biconvex shells demonstrates a not transported, autochthonous to parautochthonous nature of the brachiopods. This indicates the existence of productid brachiopod buildups in the "Zwischenschiefer" of the Badstub Formation, though the presence of intercalated lumachellic horizons is not denied. The predominance of heterotrophic filter feeders and the scarcity of calcareous algae and corals constrain an increased nutrient and siliciclastic supply, which is already seen in the impure limestone facies itself. The short duration of the brachiopod settlement is related to a sealevel rise (the eustatic rise in the lower Serpukhovian?), which for short time caused retreat of the coast line, thus diminishing and finally stopping the shedding of breccias and conglomerates from an actively rising, orogenic hinterland. Thus, the habitat of the brachiopods was a supposedly narrow, "dirty", shallow carbonate shelf adjacent to the coast. Similar intimate connections between reefal carbonates and siliclastics in a near-shore setting are; e.g.; known from the west coast of the Red Sea. We stress the fact that our interpretation is contradictory to a deeper marine fan or slope setting for the breccias of the Badstub Formation postulated by other authors.