Red algae grains from the Żurawnica Sandstone Member in the Sucha Beskidzka area (Magura Nappe, Polish Outer Carpathians) as the indicator of shallow water palaeoenvironment on the intrabasinal Tethyan ridge

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The Żurawnica Sandstone Member was deposited in the Paleocene on the northern slope of the Magura Basin in the western part of the Tethys. It is built of clastic material transported by gravitational currents from shallow parts of the Foremagura Ridge (Cieszkowski *et al*., 1999), which was an uplifted intrabasinal structure. At the top of the Żurawnica Hill (Beskid Makowski, location known as Kozie Skały) a well-exposed section crops out. It is a part of flysch succession of the Magura Nappe (Cieszkowski *et al*., 2006). In the lower part of the section thick-bedded sandstone with red algal grains occurs. Algal remnants were redeposited from the photic zone of the carbonate platform, which developed on the Foremagura Ridge. Their structure-taxonomic differentiation allows to reconstruct algal palaeoenvironment. The red algae are represented by Sporolithaceae, Melobesioideae, and Mastophoroideae genera. They correspond to three algal facies: debris, algal pavement facies, and Melobesioideae rhodolith pavement facies.

Sand-sized red algal grains are the most numerous. They are fragmented and well rounded crustaceous algal thalli, typically with no traces of bioerosion. They represent algal debris facies, which was developed in high energy environment (Nebelsick *et al*., 2005). Red algae grains could be fragmented and rounded during turbidity transport, but considering the different degree of abrasion, especially in gravel fraction, it should be assumed that the rounding took place before the turbidity transportation.

Two types of gravel grains are present: not rounded algal limestone clasts and rhodoliths. The non-rhodolith grains are built of encrusting (layered and foliose), warty, and lumpy algal crusts. Rhodoliths can be divided into two types: irregular and regular ones. Irregular rhodoliths are up to 3 cm in diameter. They contain large nuclei constituting grain skeleton. Both non-rhodolith grains and irregular rhodolits are polygeneric and contain numerous benthic organisms (bryozoans, encrusting foraminifera, and bivalves) between algal lamella, as well as constructional voids. They are bioeroded. They are elements of algal pavement facies for which the occurrence of the algal buildups with irregular rhodoliths in areas, where the energy of the environment is a bit higher is typical (Nebelsick *et al*., 2005, 2013; Bassi *et al*., 2017). The regular rhodoliths, up to 0.5 cm in size, contain small carboniferous nuclei. Typically, they are unigeneric (Sporolithaceae, Melobesioideae) and not contain other benthic organisms. Lack of constructional voids was observed in thick algal encrustation. Only encrusting growth form was observed. Regular rhodoliths are typically developed as a main part of Melobesioideae rhodoliths pavement facies, which is rather "deep" water facies of high energy environments (Adey, 1986; Bassi *et al*., 2017).

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