

Original article

Late Paleozoic reef mounds of the Carnic Alps (Austria/Italy) Bioconstructions de type « reef mounds » dans le Paléozoïque supérieur des Alpes Carniques (Autriche/Italie)

Karl Krainer

Institute of Geology and Paleontology, University of Innsbruck, Innrain 52, 6020 Innsbruck, Austria

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Abstract

The Late Paleozoic (early Kasimovian–late Artinskian) sedimentary sequence of the Carnic Alps (Austria/Italy) is composed of cyclic, shallow-marine, mixed siliciclastic–carbonate sedimentary rocks. It contains different types of skeletal mounds in different stratigraphic levels. The oldest mounds occur at the base of the Auernig Group, within a transgressive sequence of the basal Meledis Formation. These mounds are small and built by auloporid corals. Algal mounds are developed in the Auernig Formation of the Auernig Group, forming biostromes, and Lower *Pseudoschwagerina* Limestone of the Rattendorf Group forming biostromes and bioherms. The dominant mound-forming organism of these mounds is the dasycladacean alga *Anthracoporella spectabilis*. In mounds of the Auernig Formation subordinately the ancestral corallinacean alga *Archaeolithophyllum missouriense* is present, whereas in mounds of the Lower *Pseudoschwagerina* Limestone a few calcisponges and phylloid algae occur locally at the base and on top of some *Anthracoporella* mounds. Mounds of the Auernig Formation formed during relative sea level highstands whereas mounds of the Lower *Pseudoschwagerina* Limestone formed during transgression. The depositional environment was in the shallow marine, low-turbulence photic zone, just below the active wave base and lacking siliciclastic influx. The algal mounds of the Carnic Alps differ significantly from all other algal mounds in composition, structure, zonation and diagenesis; the formation of the mounds cannot be explained by the model proposed by Wilson (1975). The largest mounds occur in the Trogkofel Limestone, they are composed of *Tubiphytes/Archaeolithoporella* boundstone, which shows some similarities to the “*Tubiphytes* thickets” of stage 2 of the massive Capitan reef complex of the Guadalupe Mountains of New Mexico/West Texas.

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Résumé

Le Paléozoïque supérieur (Kassimovien inférieur–Artinskien supérieur) des Alpes Carniques (Autriche/Italie) est composé d'une série sédimentaire mixte siliciclastique et carbonatée, cyclique, de mer peu profonde. Cet ensemble contient différents types de bioconstructions (« skeletal mounds ») à différents niveaux. Les plus anciens monticules bioconstruits sont situés à la base du groupe d'Auernig, dans une séquence transgressive de la formation de Meledis basale. De taille modeste, ils sont édifiés par des tabulés auloporidés. Des biostromes algaires sont fréquents dans la formation d'Auernig du groupe éponyme et dans le Calcaire inférieur à *Pseudoschwagerina* du groupe de Rattendorf, à la fois sous forme de biostromes et de biohermes. Le principal organisme constructeur est la dasycladale seletonellacée *Anthracoporella spectabilis*. Dans la formation d'Auernig, des algues corallines ancestrales *Archaeolithophyllum missouriense* leur sont subordonnées, tandis que dans le Calcaire inférieur à *Pseudoschwagerina*, quelques calcisponges et de rares algues phylloïdes les accompagnent localement, à la base et au sommet de certains édifices. Les monticules de la formation d'Auernig se sont formés lors de hauts-niveaux marins relatifs, alors que ceux de l'autre formation ont pris naissance durant des transgressions. L'environnement de dépôt était situé en mer peu profonde, dans la zone photique, loin des apports siliciclastiques et en eaux faiblement agitées, juste sous la limite d'action des vagues. Les bioconstructions algaires des Alpes Carniques diffèrent nettement des autres monticules de ce type, par leur composition, leur structure, leur zonation et leur diagenèse ; leur formation ne peut donc pas être expliquée par le modèle proposé par Wilson (1975). Les plus grands monticules bioconstruits se rencontrent dans le Calcaire de Trogkofel. Ils sont composés de boundstones à *Tubiphytes/*

E-mail address: Karl.Krainer@uibk.ac.at.

Archaeolithoporella qui ne sont pas sans rappeler les « *Tubiphytes* thickets » du stade 2 du complexe récifal du Capitan dans les monts de Guadalupe (Nouveau Mexique et Texas occidental, États-Unis).

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Keywords: Late Paleozoic; Mounds; Auloporida corals; *Anthracoporella*; *Tubiphytes*; *Archaeolithoporella*

Mots clés : Paléozoïque supérieur ; Monticules bioconstruits ; Tabulés auloporidés ; *Anthracoporella* ; *Tubiphytes* ; *Archaeolithoporella*

1. Introduction

Most of Late Paleozoic organic buildups are mounds (reef mounds). The dominant mound-building organisms of Upper Carboniferous/Lower Permian mounds are phylloid algae (red and green algae) such as *Ivanovia*, *Eugonophyllum*, *Anchicodium*, *Archaeolithophyllum*, the enigmatic/problematic alga *Archaeolithoporella*, and the enigmatic platy organism *Palaeoaplysina* associated with *Tubiphytes* (summaries in West, 1988; James and Bourque, 1992; Wahlman, 2002). *Tubiphytes* has been revised by Riding (1993) and its correct name is *Shamovella*. But as the term *Tubiphytes* is still more popular, it is also used in this paper. Mounds constructed by non-phyllid dasycladacean and codiacean algae are rare. They are reported from the Mississippian of Nova Scotia and the Arctic Archipelago of Canada, where they occur associated with corals and bryozoans (Davies et al., 1989).

Mounds are defined as structures, which were built by smaller, commonly delicate and/or solitary elements in tranquil settings (James and Bourque, 1992). Three types of mounds are differentiated: organically controlled (a) microbial; (b) skeletal mounds (also called biogenic mounds), and (c) mud mounds

which were formed by inorganic accumulation of lime mud with variable amounts of fossils.

In skeletal mounds the skeletal builders, that is bryozoans, skeletal algae and sponges, acted as bafflers, trappers, binders and stabilizers.

In the Late Paleozoic sequence of the Carnic Alps all mounds are skeletal mounds with auloporida corals and skeletal algae (particularly *Anthracoporella*) being the dominant mound building-organisms (overview by Samankassou, 2003).

The aim of the present paper is to summarize the present knowledge of the Late Paleozoic mounds of the Carnic Alps mostly based on author's published data, which are complemented by results of recent investigations.

2. Geological setting and stratigraphy

In the Carnic Alps, an east–west-trending mountain chain in Southern Austria along the Austrian–Italian border, Late Carboniferous–Early Permian sedimentary rocks are well exposed (Fig. 1). They unconformably overlie the deformed Variscan Basement, which consists of folded and faulted Early

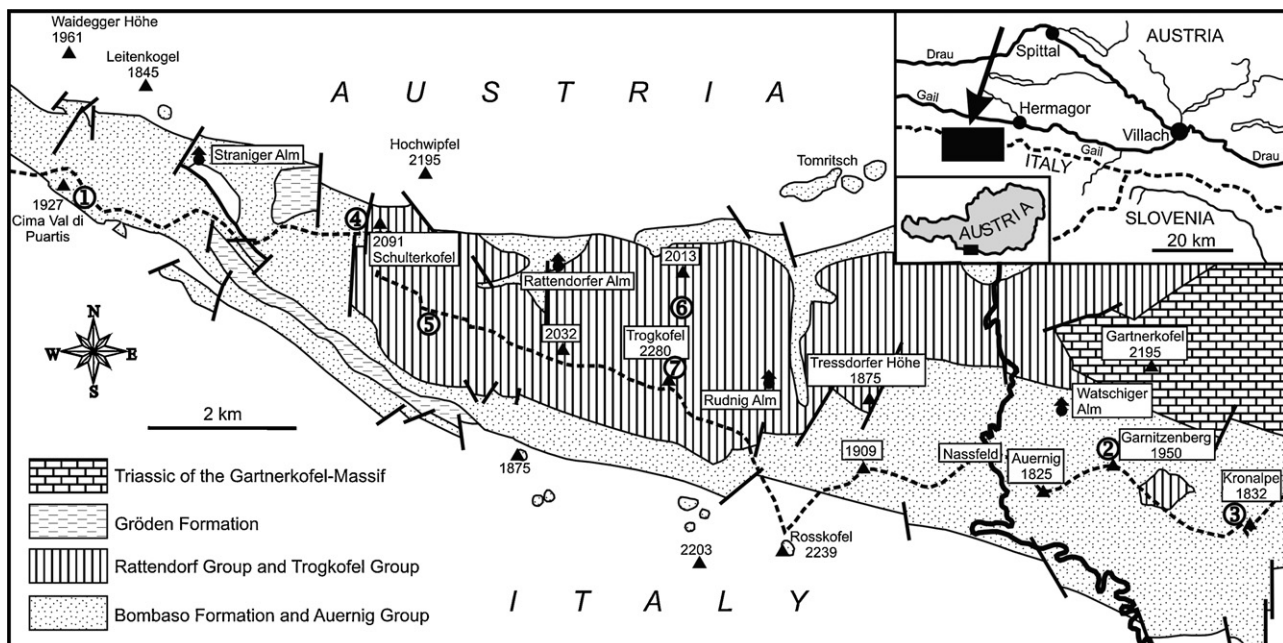


Fig. 1. Simplified geologic map of the central Carnic Alps with locations of the Late Paleozoic mounds: 1 Cima Val di Puartis (Bombaso Fm.); 2 Garnitzenberg; 3 Kronalpe (Auernig Fm.); 4 Schulterkofel; 5 Ringmauer (Lower *Pseudoschwagerina* Limestone); 6 Zweikofel; 7 Trogkofel (Trogkofel Limestone).

Fig. 1. Carte géologique simplifiée du centre des Alpes Carniques montrant l'emplacement des monticules bioconstruits du Paléozoïque supérieur. 1 Cima Val di Puartis (formation de Bombaso) ; 2 Garnitzenberg ; 3 Kronalpe (formation d'Auernig) ; 4 Schulterkofel ; 5 Ringmauer (Calcaire inférieur à *Pseudoschwagerina*) ; 6 Zweikofel ; 7 Trogkofel (Calcaire de Trogkofel).

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