

Provenance of recycled stromatolites from the Polonez Cove Formation (Oligocene) of King George Island, West Antarctica

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Summary Over 50 specimens of isolated, hemispherical in shape with well-marked multilayered growth stromatolite structures (up to 9 cm in diameter) were recovered from glaciomarine sediments of the Polonez Cove Formation (Oligocene) on King George Island (South Shetland Islands, West Antarctica). Their stratigraphic setting and the most probably Cambrian age suggest that they were recycled by the processes of iceberg-rafting into the sediments of the Polonez Cove Formation during the Oligocene glacial event (Polonez Glaciation). Stromatolites most probably derive from sedimentary Cambrian rocks with possible origins in the Ellsworth and Transantarctic Mountains. It should also be noted that until now such stromatolite structures have not been reported from Antarctica.

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Introduction

Stromatolites are among the most common and long-ranging biosedimentary structures in the fossil record, and are very useful both for environmental and stratigraphical studies. Here, I report on the occurrence of such structures in the Oligocene Polonez Cove Formation of King George Island (South Shetland Islands), West Antarctica (Figures 1-3).

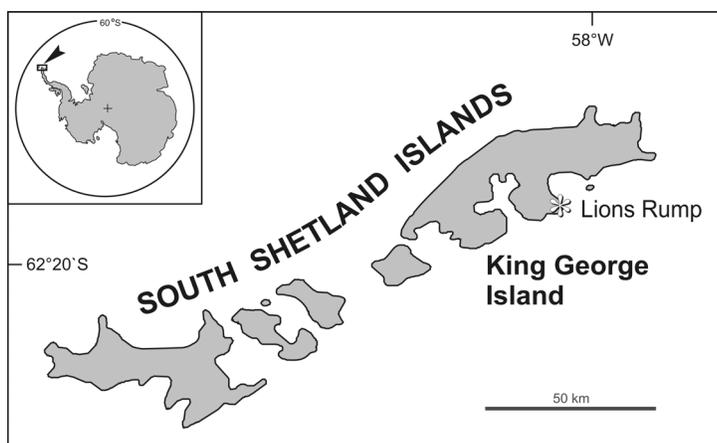


Figure 1. Location map of King George Island (arrowed) in Antarctica and the outcrop of the stromatolite-bearing strata (asterisk) of the Chlamys Ledge Member near Lions Rump (Polonez Cove Formation, Oligocene).

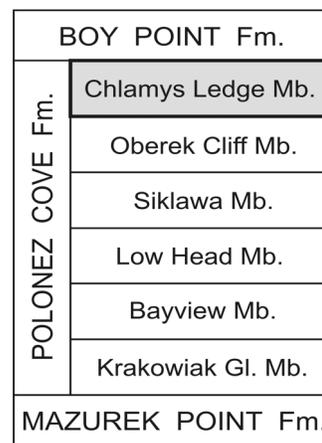


Figure 2. Polonez Cove Formation lithostratigraphy. Based on Birkenmajer (2001) and Troedson and Smellie (2002).

The Polonez Cove Formation (up to 80 m thick) consists of glaciomarine strata formed during the Polonez Glaciation (Porębski and Gradziński, 1987, Birkenmajer et al., 1991, Birkenmajer, 2001). The associated Polonez Cove Formation biota indicate favorable conditions for life in shallow marine environments during the final stage of the Gondwanaland breakup and onset of the late Eocene - Oligocene continental glaciation in West Antarctica (Gaździcki and Pugaczewska, 1984, Gaździcki, 2004, 2006, Birkenmajer et al., 2005). The glaciomarine sediments of the Polonez Cove Formation contain also a variety of glacially striated ice-rafted dropstones, represented among others by abundant exotic limestone boulders e.g., Cambrian archaeocyathan-algal boundstone of Antarctic continent provenance (Wrona, 1989).

Fossil material

The stromatolites (over 50 specimens) were recovered mostly from the upper part of the Polonez Cove Formation i.e., Chlamys Ledge Member (sensu Troedson and Smellie, 2002), where they occur sparsely within the sandstone-siltstone sequence along with abundant recycled exotic clasts (Figure 2). These, small, isolated, abiophoric or bacterial stromatolite structures are hemispherical, subspherical or turbinite in shape and characterized by smooth surfaces (Figure 3.1, 3.2a-b). The height of individual specimens ranges from 12 to 46 mm, and their width from 25 to 90 mm.

Lamination is prominent consisting of gently to steeply convex alternating dark (micrite) and light (sparite) laminae (Figure 3.3-4).

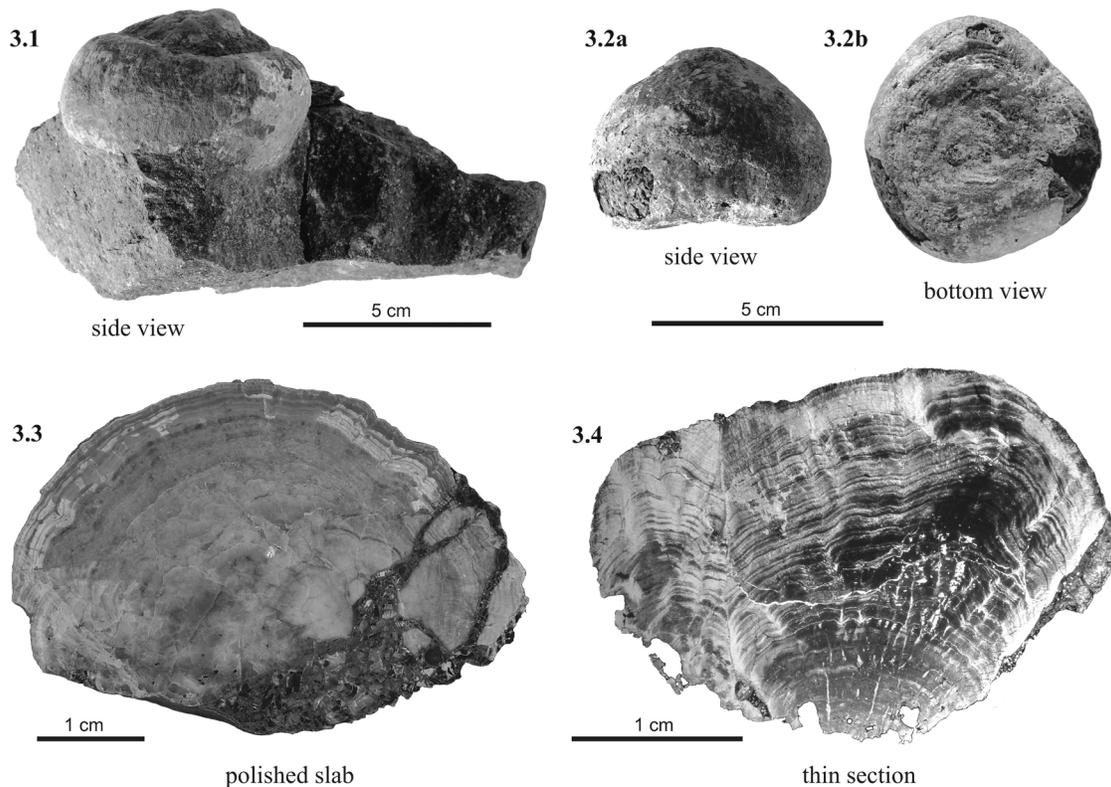


Figure 3. Stromatolite structures recovered from the Chlamys Ledge Member.

Discussion

The King George Island glacial erratics occurring along with the studied stromatolite structures (Figure 3) are believed to have been derived mainly from the Ellsworth Mountains and from the Transantarctic Mountains (Birkenmajer and Butkiewicz, 1988, Wrona 1989).

Exotic limestone glacial erratics from the Oligocene Polonez Cove Formation and the Miocene Cape Melville Formation of King George Island have yielded the Cambrian biota: archaeocyaths, lingulate brachiopods, trilobites and small skeletal fossils, mostly sclerites of cancellorids, tommotiids, paleoscolecid worms and hyoliths (see Gaździcki and Wrona, 1986, Wrona, 2003, 2004). The lithological and fossil assemblages of the limestone iceberg-rafted dropstones of King George Island are closely similar to that from the autochthonous Cambrian sequences from the Transantarctic and Ellsworth Mountains (see Rowell and Evans, 1988, Evans and Rowell, 1990, Evans, 1992, Rowell et al., 1992). These similar facies development and almost the same Cambrian fossil contents support their provenance from the Antarctic continent. So, the recycled stromatolites from King George Island also most probably derive from sedimentary Cambrian successions with possible origins in the Ellsworth and Transantarctic Mountains. They have been accumulated in the sediments of the Oligocene Polonez Cove Formation on King George Island as a result of iceberg-rafting.

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