Development of a *Palaeoaplysina* Reef Complex, Ellesmere Island, Canadian Arctic

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Summary

In the Sverdrup Basin of the Canadian Arctic Archipelago, major carbonate reef complexes formed during the late Paleozoic. A major constituent of these reefs in an organism known as *Palaeoaplysina*, a plate-like fossil identified by a platy calcareous skeleton which hosts a system of canals, a cellular skeleton, and protuberances referred to as mamelons on the upper side. Although the affiliation of *Palaeoaplysina* is debated, with opinion split between a plant (alga) and animal (hydrozoa or sponge) origin, a study of well preserved specimens from Blind Fiord on Ellesmere Island demonstrated the presence of a bimodal cellular structure leading to the classification *Palaeoaplysina* as a red alga, related to the ancestral coralline algae *Archaeolithophyllum* (Vachard and Kabanov, 2007; Anderson and Beauchamp, 2010).

In Russia some of the world`s most productive hydrocarbon structures are hosted in *Palaeoaplysina* reefs with successful explorations undertaken throughout the Urals. Similar buildups have been exploration targets in the Barents Sea and will likely form a significant part of future exploration in the Canadian Arctic. Although stratigraphic studies on the Canadian Arctic reef formations was conducted in the 1980's and 1990's (e.g. Beauchamp et al., 1989; Henderson et al., 1995) little in-depth work has been done into the detailed buildup history and geometry, or the role *Palaeoaplysina* played in their development. This study investigates the ecological significance of *Palaeoaplysina*, focusing on their role in reef sedimentation and their contributions to the growth of carbonate buildups.

On Ellesmere Island, *Palaeoaplysina*-bearing buildups are found as patch reefs, banks and mounds of Moscovian to Asselian age (Beauchamp *et al.*, 1989). *Palaeoaplysina* is very abundant in the platform carbonate and buildups of the Nansen, Belcher Channel and Tanquary formations (Davies and Nassichuk, 1973). During this time, fluctuations in sea level, likely due to Gondwana glacier advance and retreat, led to a series of high frequency transgressive-regressive sequences (Embry and Beauchamp, 2008). Internal buildup geometries of the platform carbonates of the Nansen Formation were mapped in proximity to a *Palaeoaplysina*-dominated reef west of Blind Fiord on southwest Ellesmere Island. Reef architecture was defined in order to delineate the internal relationships with adjacent reef structure and surrounding strata, and to determine internal stages of development. The west and east ends of the reef, and the reef and off-reef were compared, focusing on the relationships between *Palaeoaplysina* plates, their encrusting micro

fauna and micro algal flora, and the surrounding sediments. This detailed analysis will be used to interpret the role *Palaeoaplysina* played in reef sedimentation. Comparisons with analogous reefs in similar environments outside of *Palaeoaplysina*'s spatio-temporal range will allow the recognition of organisms which shared the same niche as *Palaeoaplysina*.

The reef system at West Blind Fiord consists of a complex series of coalesced reefs which began as low-relief tabular build-ups, and eventually grew into large high-relief reef mounds which nucleated at several different locations at a similar stratigraphic level. These reefs over time coalesced into a single complex reef structure. *Palaeoaplysina* is extremely common in the tabular build-ups below the main reef build-up, as well as being the dominant constituent ("Palaeoaplysinite") of the main build-up. *Palaeoaplysina* played an important role in reef growth by providing a sediment baffle and trap.

References

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