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Survey of Cretaceous marine invertebrate occurrences on the Antarctic Peninsula (Fossil Bluff, Byers, Gustav and Marambio Groups)[1]

Levantamento das ocorrências de invertebrados marinhos Cretáceos na Península Antártica (grupos Fossil Bluff, Byers, Gustav e Marambio)

Estudio de la presencia de invertebrados marinos del Cretácico en la Península Antártica (Grupos Fossil Bluff, Byers, Gustav y Marambio)

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Abstract: Recently, papers were published on bibliographic surveys on the occurrence of vertebrates and microfossils in the surroundings of the Antarctic Peninsula, but none addressed fossil invertebrates. This paper aims to survey the occurrences of marine Cretaceous invertebrates in Antarctica Peninsula. The better studied invertebrates in the Marambio (Santonian-Maastrichtian), Gustav (Hauterivian-Coniacian), Fossil Bluff (Berriasian-Albian) and Byers (Berriasian-?Santonian) groups are cephalopods (ammonoids and belemnites) and bivalves. The faunas of the mentioned groups are significantly different from each other, but this is possibly due to different paleoenvironmental conditions, incompleteness of the geological record and a lack of studies in some Antarctic regions. Furthermore, in most cases the formations of the aforementioned groups have different ages, which also implies different faunas. We recognized ecological guilds for each stratigraphic group in the Antarctic Cretaceous. Marambio Group has the highest number of guilds, whereas Byers Group has the lowest. Most recognized guilds are composed of epifaunal or nektonic animals and subordinately there are deep infaunal to semi-infaunal invertebrate guilds. We conclude that there are few studies correlating variation in faunal diversity with environmental changes in the Cretaceous of the Antarctic Peninsula. Collections with more refined stratigraphic control of taxa also need to be conducted in all geological units.
Keywords: paleoinvertebrates, Lower and Upper Cretaceous, Alexander Island, James Ross archipelago, South Shetland Islands.

Resumo: Recentemente, foram publicados artigos sobre levantamentos bibliográficos sobre a ocorrência de vertebrados e microbiotas fósseis no entorno da Península Antártica, mas nenhum abordou invertebrados fósseis. Este artigo tem como objetivo fazer um levantamento das ocorrências de invertebrados marinhos do Cretáceo na Península Antártica. Os invertebrados mais estudados nos grupos Marambio, Gustav, Fossil Bluff e Byers são os cefalópodes (ammonóides e belemnitas) e os bivalves. As faunas dos grupos Byers, Fossil Bluff, Gustav e Marambio são significativamente diferentes, mas isso possivelmente se deve a diferentes condições paleoambientais, à incompletude do registro geológico e à falta de estudos em algumas regiões antárticas. Além disso, na maioria dos casos as formações dos referidos grupos apresentam idades

diferentes, o que também implica faunas distintas. Neste trabalho foram reconhecidas guildas ecológicas para cada grupo estratigráfico no Cretáceo Antártico. O Grupo Marambio tem o maior número de guildas, enquanto o Grupo Byers tem o menor. As guildas mais reconhecidas são compostas por animais epifaunais ou nectônicos e subordinadamente há guildas de invertebrados de infauna profunda a semi-infaunal. Conclui-se que existem poucos estudos correlacionando a variação na diversidade faunística com as mudanças ambientais no Cretáceo da Península Antártica.
Palavras-chave: paleoinvertebrados, Cretáceo Inferior e Superior, Ilha Alexander, Arquipélago James Ross, Ilhas Shetland do Sul.

Resumen: Recientemente, se publicaron artículos sobre estudios bibliográficos sobre la presencia de vertebrados fósiles y microbiota en la Península Antártica, pero ninguno abordaba los invertebrados fósiles. Este artículo tiene como objetivo estudiar la presencia de invertebrados marinos del Cretácico en la Península Antártica. Los invertebrados más estudiados de los grupos Marambio, Gustav, Fossil Bluff y Byers son los cefalópodos (amonoides y belemnitas) y los bivalvos. Las faunas de los grupos Byers, Fossil Bluff, Gustav y Marambio son significativamente diferentes, pero esto posiblemente se deba a diferentes condiciones paleoambientales, lo incompleto del registro geológico y la falta de estudios en algunas regiones antárticas. Además, en la mayoría de los casos las formaciones de los grupos antes mencionados son de diferentes edades, lo que implica también diferentes faunas. En este trabajo se reconocieron gremios ecológicos para cada grupo estratigráfico en el Cretácico Antártico. El Grupo Marambio tiene el mayor número de gremios, mientras que el Grupo Byers tiene el menor. Los gremios más reconocidos están compuestos por animales epifaunales o nectónicos y subordinadamente existen gremios de invertebrados infaunales profundos a semiinfaunales. Se concluye que existen pocos estudios que correlacionen la variación de la diversidad faunística con los cambios ambientales en el Cretácico de la Península Antártica.
Palabras clave: paleoinvertebrados, Cretácico Superior y Inferior, isla Alexander, archipiélago James Ross, islas Shetland del Sur.

INTRODUCTION

Since the mid-19th century, scientific expeditions to Antarctica have made considerable progress in understanding the stratigraphy and paleontology of the region.

The first fossil was described from the Antarctic Peninsula area by Eights (1833), who discovered fossilized tree wood with preserved growth rings on King George Island but did not collect the specimen. About 60 years passed before the first collection of Antarctic fossils was conducted when Carl Larsen, prospected on Seymour Island, between the years 1892 and 1893 (Stilwell & Long, 2011).

The first formal description of fossils from Antarctica is due to Sharman and Newton (1894), who analyzed, among other groups, bivalves and gastropods collected by Larsen in the Eocene of Seymour Island. Weller (1903) published the first works on specimens from the Antarctic Mesozoic, analyzing ammonoids, gastropods, serpulids and decapods from Snow Hill Island. Although Weller (1903) said that the fossils were collected during the Belgian Antarctic Expedition, in fact the fossils he described were specimens stolen by Stokes from the Otto Nordenskjöld Expedition (see Anderson, 1906).

The geologist Otto Nordenskjöld, leader of the Swedish Expedition to the South Pole (1901-03), was a pioneer in recognizing the paleobiogeographic importance of Antarctica, where he believed it was possible and proposed that many living beings that inhabit the planet may have emerged in that region and then migrated to lower latitudes. Later, other authors came to the same conclusion, based on the occurrence of Mollusca (*Garmardia*, *Aulacomya*, *Eurhomalea*, *Longimactra* and *Gomphina*), Echinodermata (*Ctenophoraster*, *Zoroaster* and *Metacrinus*), Arthropoda (*Lyreidus* and *Chasmocarcinus*) (see Zinsmeister & Feldman, 1984) and Chondrichthyes (*Ischyodus dolloi*) (Stahl & Chatterjee, 2003). This discussion in along the decades included important factors to this hypothesis, as the climate changes in the Cenozoic as driving factors to the migration of Antarctic biotas to other regions. This is a pivotal point that justifies the importance of studies on this fauna (e.g., Crame, 1992; Crame et al., 2014).

Recently, papers were published on bibliographic surveys on the occurrence of vertebrates and fossil microbiotas in the surroundings of the Antarctic Peninsula (e.g., Acosta Hospitaleche et al., 2019; Amenábar et al., 2019; Buono et al., 2019; Gelfo et al., 2019; Lamanna et al., 2019; O'Gorman et al., 2019; Reguero, 2019), but none addressed fossil invertebrates. Although Witts (2016) and Witts et al. (2016) presented a large survey of invertebrates from part of the Cretaceous, they focused mainly on mollusks and did not survey all existing previous work on the topic, whereas Bastias et al. (2023) focused on the South Shetland Islands region. To this end, this paper aimed to make a bibliographic survey of the occurrences of marine Cretaceous invertebrates in the Antarctic Peninsula recorded in the literature so far, which will subsidize future research. In addition, we recognized ecological guilds for each stratigraphic group, and we compared the faunal differences between the western and eastern portions of the Antarctic Peninsula.

MATERIALS AND METHODS

This bibliographic review was conducted through a wide search in the Paleobiology Database, journals, dissertations, and thesis available digitally, present in several websites (Google Scholar, Capes basis, Web of Science, among others). From these a document was prepared containing relevant scientific information (taxon, taxon ecology, author and year, geological unit, location, and age) (Supplementary Material), on which this paper is based. From the Paleobiology Database and the most up-to-date bibliography addressing taxonomy of Antarctic Peninsula Cretaceous invertebrates we reviewed and updated the names of some taxa that had their names synonymized after being described for Antarctic Cretaceous. All the taxa and related references are in the supplementary material. Many taxa are described in the literature with open nomenclature for various reasons, however here we chose to maintain this nomenclature as the authors described, as it is not the intention of this manuscript to make a taxonomic review of Antarctic taxa, but only a compilation of occurrences. The specimens listed here are not tied in detail to stratigraphic levels, nor do we include the first and last appearance of each taxon. It is important to emphasize this to avoid interpretative errors generated by the Lazarus effect, Signor-Lipps effect or facies-restricted taxa.

The PAST software was used to perform the statistical tests of Principal Component Analysis (PCA), variance/covariance matrix, and species richness. The PCA was used to correlate taxonomic groups, environments and papers to understand which variables influence the distribution and richness of fauna in geological units of Antarctica. We assigned on numbers to convert qualitative data from the "environment" category to quantitative data: 10 – abyssal to below the slope, 20 – base of the slope, 30 - offshore (above the slope), 40 - offshore transition to shoreface.

The species richness was used to observe changes in the number of taxa occurring in each Antarctic Cretaceous formation over geological time. The distribution in guilds of species recorded for Antarctica was conducted based on their life habit (infaunal, semi-infaunal and epifaunal), their mode of feeding (suspensivores, detritivores, carnivores, herbivores, omnivores, chemosymbionts, scrapers) and their motility (active mobile, facultative mobile and sessile). These data were extracted from the literature (*e.g.*, Aberhan, 1994) and from a database (Paleobiology Database) with trophic information about individuals in a generic and specific way. When information on feeding behavior was not available at the species level, congeners or family members were considered. Finally, we used The Two Way Joining to observe the richness of taxonomic groups by geological unit. The use of the Two-Way Joining technique can be justified for several reasons in ecological studies, particularly when dealing with datasets containing multiple environmental or biological variables. One key advantage is its ability to identify complex patterns by grouping samples that share similarities in both environmental variables and taxonomic composition (Alroy, 2015).

RESULTS

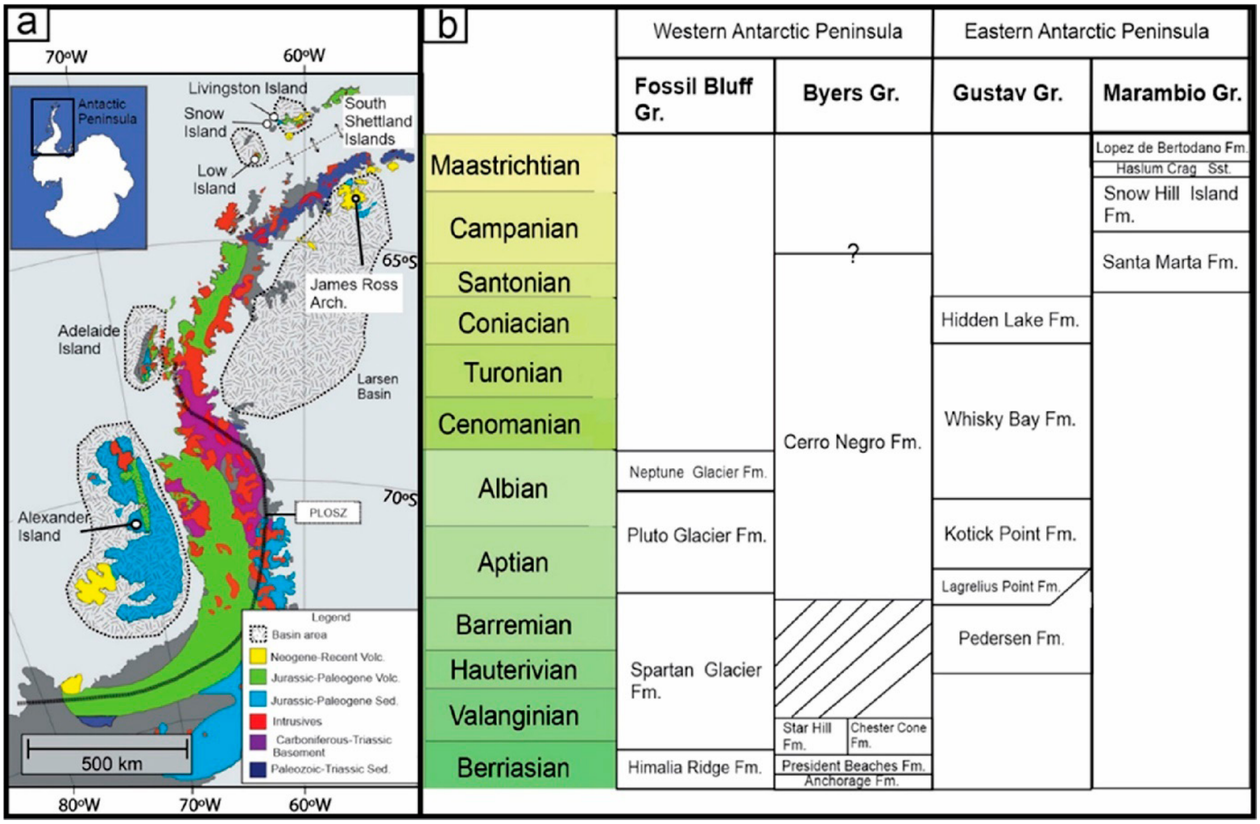
This article focused on the outcropping Cretaceous in the Antarctic Peninsula region. Here are the occurrences of macroinvertebrates in the main fossiliferous locations to the east and west of the peninsula (figures 1 and 6; supplementary material).

Eastern Antarctic Peninsula

The occurrence of Cretaceous invertebrate fossils east of the Antarctic Peninsula is concentrated in the Larsen Basin (back-arc basin) (Hathway & Lomas, 1998; Hathway, 2000), especially in the James Ross Island archipelago, including James Ross, Seymour/Marambio, Snow Hill and Vega islands; beyond Robertson Island.

The sedimentary successions analyzed represent part of the James Ross sub-basin filling which, according to Del Valle et al. (1992), constitutes the northern segment of the Larsen Basin. According to Hathway (2000), the James Ross sub-basin formed in the southernmost South America–Antarctic Peninsula region as a result of lithospheric extension linked to the early stages of Gondwanan break-up, and subsequently developed in a back-arc setting relative to the continuous Antarctic Peninsula magmatic arc (Bastias et al., 2019, 2021).

Figure 1: a - Simplified geological map of the Antarctic Peninsula region. PLOSZ - Palmer Land Oriental Shear Zone (adapted from Burton-Johnson and Riley 2015, Bastias et al. 2019). Gustav and Marambio groups outcrop in James Ross Island archipelago, Fossil Bluff Group outcrop on Alexander Island and Byers Group outcrop on Livingston and Snow islands. b - Main stratigraphic units of the Cretaceous in the Antarctic Peninsula region



Source: adapted from Hathway and Riding (2001) and Crame et al. (2006), Gustav Group; Olivero (2012), Marambio Group; Butterworth et al. (1988) and Moncrieff and Kelly (1993), Fossil Bluff Group; and Bastias et al. (2019), Byers Group).

James Ross Island (Gustav Group)

The Gustav Group reaches its maximum development on the northwest coast of James Ross Island and in certain isolated areas in the northeast of the Antarctic Peninsula (Riding & Crame, 2002). Along James Ross Island shore adjacent to the Prince Gustav Channel, its sedimentary succession has a maximum thickness of 2.6 km and is characterized by coarse-grained lithologies, such as conglomerates, breccias and pebbly sandstones with subordinate occurrence of fine-grained sandstones, siltstones and claystones (Riding & Crame, 2002; Crame et al., 2006).

This unit is formally subdivided into the Lagrelius Point (Aptian), Kotick Point (Aptian-Albian), Whisky Bay (Albian-Turonian) and Hidden Lake (Coniacian) formations, with their sediments deposited in a deep marine environment, in proximal subsea fan systems and slope foothills (Riding & Crame, 2002; Crame et al., 2006). According to Hathway & Riding (2001) the Pedersen Formation (Hauterivian?-Aptian?), which outcrops in the Nunatak Pedersen and in the Sobral Peninsula, is laterally correlated to the Lagrelius Point Formation. Hathway (2000) asserts that the Mesozoic succession in Larsen Basin can be divided into a series of megasequences, separated by boundaries that record periods of changing basin geometry. The Gustav Group Aptian-Coniacian interval represents an aggradational deep-marine clastic wedge deposited along the fault-bounded western basin margin, during the main phase of the arc uplift and extension (Hathway, 2000; Riding & Crame, 2002).

The oldest works on invertebrate paleontology of the Gustav Group date back to the 1960s. Most of the works deal with description of ammonoids (Howarth, 1966; Medina et al., 1982; Ineson et al., 1986; Olivero & Palamarczuk, 1987; Hathway & Riding, 2001; Crame et al., 2006; Kennedy et al., 2007) and bivalves (Medina et al., 1982; Crame, 1983; Ineson et al., 1986; Medina & Buatois, 1992; Crame et al., 2006; Kennedy et al., 2007). However, there are also records of belemnites (Medina et al., 1982; Doyle, 1985, 1990; Crame et al., 1996, 2006), annelids (Medina et al., 1982), gastropods (Medina et al., 1982), brachiopods (Sandy, 1991; Crame et al., 2006), porifera (Vodrazka & Crame, 2011) and bryozoans (Crame et al., 2006). The fossils were all collected on James Ross Island and are summarized below (supplementary data).

James Ross Island archipelago (Marambio Group)

The Marambio Group basal unit, represented by the Santa Marta Formation, conformably overlies the Hidden Lake Formation (uppermost Gustav Group) and according to Crame et al. (1991): “the gradation between the two groups is marked by a slight, but nonetheless distinctive, change into softer, more recessive-weathering lithologies, with a paler grey brown weathering color”. It has a maximum thickness of 2.5 km and outcrops on the James Ross, Vega, Snow Hill, Humps, Seymour, and Cockburn islands (Crame et al., 2006; Olivero, 2012). This unit is characterized by a variety of fine to medium-grained sandstones, siltstones, mudstones and coquina, being quite fossiliferous and containing sets of vertebrates, invertebrates, plants and microfossils (e.g., Salgado & Gasparini, 2006; Olivero, 2012; Carvalho et al., 2013; Guerra et al., 2015; Videira-Santos et al., 2020).

The Marambio Group is subdivided into the Santa Marta (Santonian—middle Campanian), Snow Hill Island (late Campanian—early Maastrichtian) and López de Bertodano (late Maastrichtian—Danian) formations (see Olivero, 2012). According to Crame et al. (1991), the Santa Marta Formation represents deposition in a sub-storm wave base, mid- to outer shelf environments. The Snow Hill Island Formation most basal unit, the Cape Lamb Member, was defined by Roberts et al. (2014) as a prograding delta wedge at mid- to outer shelf environments; and its uppermost unit, the Haslum Crag Member, according to Olivero (2012) represents a shallower marine shelf closer the shoreline. The lower half of the López de Bertodano Formation successions on Seymour and Snow Hill islands (about 1000 m thick) were interpreted as a shallow marine and estuarine transgressive deposits;

and a transgressive shelf under storm conditions followed by a regressive trend, with mid- to inner shelf depositional environments in the uppermost section (Macellari, 1986, 1988; Crame et al., 1991; Pirrie et al., 1997; Crame et al., 2006; Olivero, 2012; Milanese et al., 2020).

The overlying Sobral Formation is of Danian age (Milanese et al., 2020 and references therein), and was deposited in a range of shallow marine shelf and deltaic environments. The invertebrate fossils of the Marambio Group have been known since the beginning of the 20th century. As in the Gustav Group, the most studied groups are ammonoids (Kilian & Reboul, 1909; Spath, 1953; Howarth, 1958; Del Valle et al., 1982; Macellari, 1986; Olivero, 1988; Lirio et al., 1989; Olivero & Zinsmeister, 1989; Askin et al., 1991; Stilwell, 2002; Olivero, 2012, b; Raffi & Olivero, 2016; Olivero & Raffi, 2018; Tobin et al., 2018; Raffi et al., 2019) and the bivalves (Del Valle et al., 1982; Lirio et al., 1989; Askin et al., 1991; Scasso et al., 1991; Crame et al., 1996; Stilwell, 2002; Beu, 2009; Olivero, 2012; Crame et al., 2014; Witts et al., 2015, 2016; Tobin et al., 2018; Luther unpublished data).

Belemnites are also recorded from this group (Kilian & Reboul, 1909; Doyle, 1990; Crame et al., 1996), nautiloids (Kilian & Reboul, 1909; Spath, 1953; Del Valle et al., 1982; Cichowolski et al., 2005; Witts et al., 2015), brachiopods (Owen, 1980; Sandy, 1991) gastropods (Weller, 1903; Wilckens, 1910; Del Valle et al., 1982; Macellari, 1984; Zinsmeister et al., 1989; Scasso et al., 1991; Askin et al., 1991; Zinsmeister & Griffin, 1995; Olenik & Zinsmeister, 1996; Stilwell & Zinsmeister, 2002; Stilwell & Zinsmeister, 2003; Crame et al., 2004; Beu, 2009; Harasewych et al., 2009; Crame et al., 2014; Witts et al., 2016; Tobin et al., 2018), scaphopods (Medina & Del Valle, 1985; Stilwell & Zinsmeister, 1987; Stilwell, 1999), annelids (Ball, 1960; Del Valle et al., 1982; Macellari, 1984; Stilwell & Zinsmeister, 1987; Scasso et al., 1991; Stilwell, 2002; Olivero, 2012; Tobin et al., 2018; Luther unpublished data), decapods (Ball, 1960; Del Valle et al., 1982; Urreta, 1989; Askin et al., 1991; Aguirre-Urreta & Olivero, 1992; Stilwell, 2002; Pinheiro et al., 2020), cirripeds (Luther unpublished data), ostracods (Fauth et al., 2003), crinoids (Luther unpublished data), equinoids (Lambert, 1910; Néraudeau et al., 2000) and corals (Felix, 1909; Darrel & Taylor, 1993; Filkorn, 1994; Videira-Santos et al., 2020, 2022). The mentioned fossils (supplementary data) were collected on the James Ross, Seymour/Marambio, Snow Hill, Vega, Cockburn, and Humps islands.

Robertson Island

Tobin et al. (2020) described Robertson Island invertebrates from Cape Marsh. Possibly on this island, the Santa Marta and Rabot formations (or the lower portion of the Snow Hill Island Formation) outcrop. Few studies have described invertebrates on Robertson Island before Tobin et al. (2020), such as Fleet (1966), Cichowolski et al. (2005) and Medina & Del Valle (1980).

Kenyon Peninsula

Thomson (1967) described possible Cretaceous invertebrates from the region of the Kenyon Peninsula (Crabeater Point, Bowman Coast, Antarctic Peninsula), but the author was unable to specify whether it is Early or Late Cretaceous.

Western Antarctic Peninsula

The Cretaceous to the west of the Antarctic Peninsula was deposited in the Byers Basin (forearc) (Hathway & Lomas, 1998; Bastias et al., 2019) and outcrops mainly on Alexander Island and subordinately on Livingston Island. Fossils from this region were collected only in layers of the Early Cretaceous.

Alexander Island

The Fossil Bluff Group forms one of the most complete relatively forearc successions globally with a sedimentary record almost 8 km in thickness (Butterworth et al., 1988; Riley et al., 2023). This unit is composed mainly of clastic sedimentary rocks (Doubleday & Storey, 1998). The group is subdivided into the Ablation Point (Kimmeridgian), Himalia Ridge (Tithonian-Berriasian), Spartan Glacier (Valangian-Barremian), Pluto Glacier (Aptian-Albian) and Neptune Glacier (Albian) formations (Moncrieff & Kelly, 1993; Doubleday & Storey, 1998; Nichols & Cantrill, 2002). A considerable part of these deposits has a marine origin with an abundant volcaniclastic contribution from the magmatic arc except for the Triton Point Member of the Neptune Glacier Formation, related to fluvial environments (Kelly et al., 1996; Nichols & Cantrill, 2002).

Fossils from Alexander Island have been known since the 1950s. The invertebrate groups recorded in the Fossil Bluff Group are ammonoids (Howarth, 1958; Thomson, 1972a, b, 1974, 1979, 1983; Crame & Howlett, 1988; Howlett, 1989; Kelly & Moncrieff, 1992), belemnites (Wiley, 1972, 1973; Crame & Howlett, 1988), bivalves (Thomson & Wiley, 1972; Willey, 1975a, b, c; Crame, 1983, 1985; Crame & Howlett, 1988; Kelly & Moncrieff, 1992; Crame & Kelly, 1995; Kelly, 1995; Crame 1996), gastropods (Cox, 1953; Thomson, 1971), annelids (Cox, 1953), brachiopods (Thomson & Owen, 1979), crinoids (Taylor, 1966), echinoids (Taylor, 1966; Smith & Crame, 2012), ophiuroids (Taylor, 1966; Smith & Crame, 2012), decapods (Taylor, 1979; Urreta, 1989) and cirripeds (Taylor, 1965; Collins, 1980).

The fossils of the Fossil Bluff Group all come from Alexander Island from locations such as Fossil Bluff, Ablation Valley, north of Pluto Glacier, Succession Cliffs, Mount Ariel, south of Uranus Glacier, Waitabit Cliffs and Keystone Cliffs.

Livingston Island (Byers Peninsula)

The Byers Peninsula is located in the westernmost part of Livingston Island, belonging to the continental block of the South Shetland Islands, which is part of a Jurassic-Quaternary forearc generated by Meso-Cenozoic subduction processes along the South Shetland Islands Trench (Smellie et al., 1984; Alfaro et al., 2010; Bastias et al., 2019). The Byers Group is composed of sedimentary and igneous Mesozoic rocks and outcrops on the Byers Peninsula (Livingston Island) and Rugged Island (Crame et al., 1993; Hathway & Lomas, 1998). This group has also been linked to Jurassic-Cretaceous packages outcropping on Snow (President Head) and Low (Cape Wallace) islands and potentially with Alexander Island (Bastias et al., 2019).

This group is 2.7 km thick and is characterized by a sequence of clastic rocks of marine origin, overlaid by volcanoclastic strata of non-marine origin (Smellie et al., 1984; Crame et al., 1993; Hathway & Lomas, 1998). The Byers Group can be divided into the following formations: Anchorage (Late Jurassic), President Beaches (Berriasian), Start Hill (Berriasian - Valanginian), Chester Cone (late Berriasian – early Valanginian) and Cerro Negro (Aptian) (Hathway & Lomas, 1998; Bastias et al., 2019, 2023), the latter encompasses all continental volcanoclastic strata (Bastias et al., 2019). The invertebrate fauna of this group is not yet well known (supplementary data).

On Livingston Island, so far, there are records of ammonoids (González-Ferrán et al., 1970; Tavera, 1970; Covacevich, 1976; Crame et al., 1993; Kiessling et al., 1999; Dochev et al., 2017), belemnites (Crame et al., 1993), bivalves (Covacevich, 1976; Crame et al., 1993; Crame, 1995; Crame & Kelly, 1995), scaphopods (Covacevich, 1976), gastropods (Covacevich, 1976) brachiopods and annelids (Crame et al., 1993).

Snow Island (President Head)

As mentioned earlier, Snow Island's Cretaceous packages have been linked to the Byers Group (Crame et al., 1993). These packages possibly belong to the Chester Cone and Cerro Negro formations (Hathway & Lomas, 1998; Torres et al., 1997; Bastias et al., 2023; Ugalde et al., 2013; Israel unpublished data, Bastias et al., 2019; 2023).

Ecological Guilds

According to the morphological similarity, way of life and feeding strategy, we preliminarily subdivided the Cretaceous taxa present in the Antarctic Peninsula into ecological guilds, showing groupings of specimens that lived in the same living environment, their ecological habits, how it exploited resources (supplementary data).

The study of guilds is a valuable tool to understand changes in occupation in eco-space over geological time (*e.g.*, Frey et al., 2014). However, for the Cretaceous units of the Antarctic Peninsula area, this is still a preliminary study (see discussion).

The number of guilds in the geological units generally follows the increase in species richness, tending to increase in the shallower shelf environments both in the west (Byers Group - 14 guilds; and Fossil Bluff Group - 39 guilds) and in the east of the Antarctic Peninsula (Gustav Group - 18 guilds; and Marambio Group - 53 guilds). Pluto Glacier and Neptuno Glacier formations, which represent offshore to shoreface environments, are the geological units with the highest species richness and the highest number of guilds on the western side of the peninsula. On the east side, the highest species richness and the greatest number of guilds are represented in the Marambio Group units, also offshore to shoreface environments (see figure 6 and supplementary data, Tables V-VIII).

This paper takes a descriptive, rather than an interpretative, approach, as it is not yet possible to establish trophic relationships among the recognized guilds. It is important to note that ecological guilds are directly related to trophic levels and food chains, which are not proposed in this study.

DISCUSSION

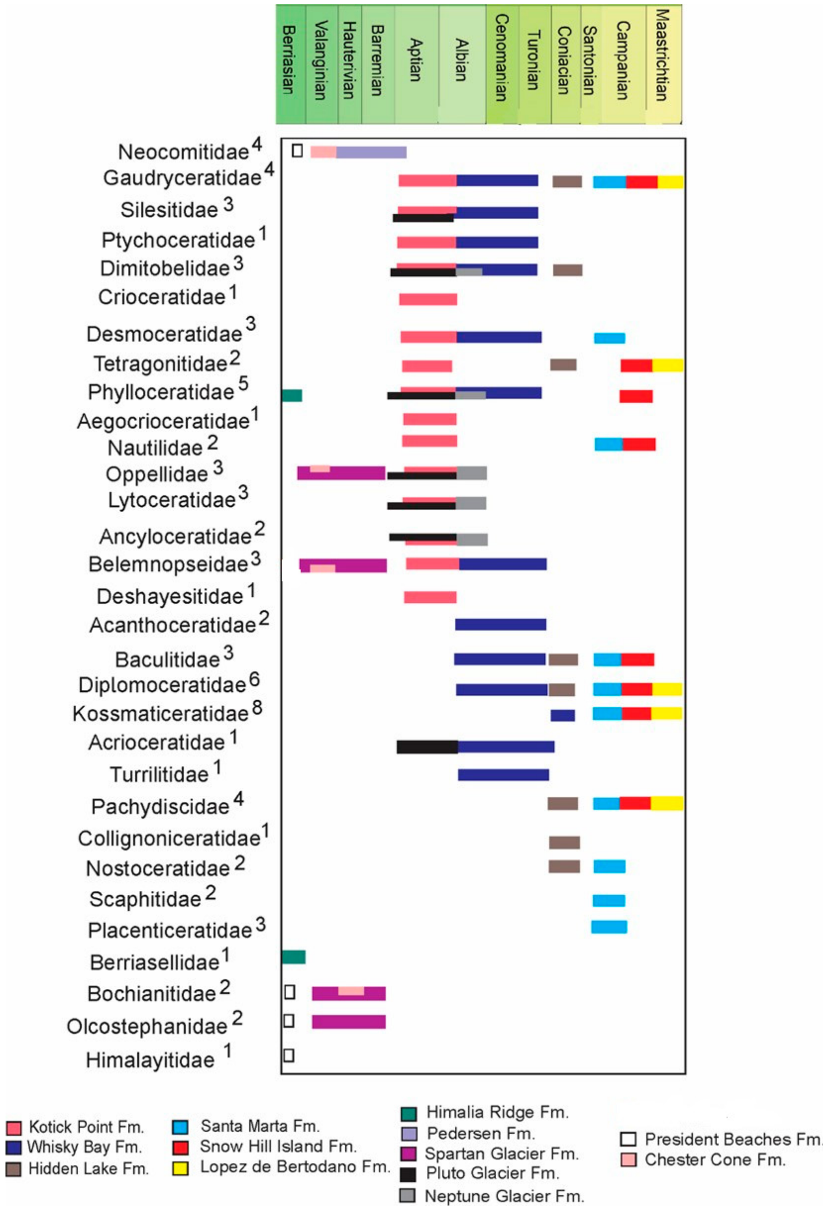
The Late Cretaceous invertebrate fauna of Antarctica is said to belong to the Weddelian Biogeographic Province (*e.g.*, Zinsmeister, 1979, 1982), which included, in addition to Antarctica, the seas of New Zealand, Australia and South America (Patagonia). Furthermore, an endemic high-latitude austral fauna has been recognized for some taxa of cephalopods and bivalves in the Early Cretaceous in Antarctica (*e.g.*, Crame, 1987; Doyle, 1987).

The back-arc basins (east of the Antarctic Peninsula) went from a deeper to a shallower marine environment due to progradation from the existing magmatic arc of the Early Cretaceous (Kotick Point, Lagrellius Point, Whisky Bay and Hidden Lake formations) to the Late Cretaceous (Santa Marta, Lopez de Bertodano, Sobral and La Meseta formations). On the other hand, in the forearc basins (west of the Antarctic Peninsula) there was a deeper marine environment throughout the Cretaceous due to subduction north of the South Shettland Islands (*e.g.*, Farquharson et al., 1984; Elliot, 1988; Pirrie & Crame, 1995; Hathway, 2000; Jordan et al., 2020).

The only formations of marine origin of about same age in the Cretaceous of the Antarctic Peninsula region are Himalia Ridge and President Beaches base of Spartan Glacier, Star Hill and Chester Cone (Berriasian-Valanginian), top of Spartan Glacier and Lagrelius Point/Pedersen (Hauterevian-Aptian), Pluto Glacier and Kotick Point (Aptian-Albian), and Neptune Glacier and base of Whisky Bay (Albian-Cenomanian). From the Cenomanian to the end of the Cretaceous there are no records of marine rocks in the western portion of the Antarctic Peninsula.

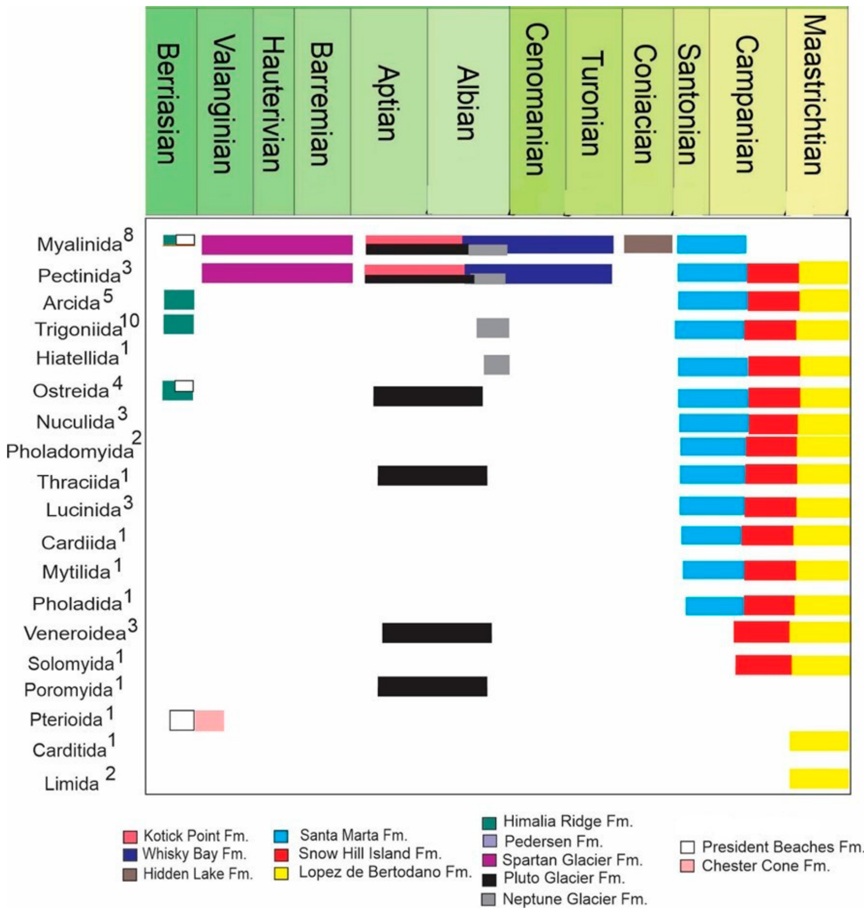
Based on the stratigraphic distribution of the taxa (figures 2, 3 and 4), we perceived that few taxa that occurred synchronously both west of the Antarctic Peninsula, found in the Kotick Point and Whisky Bay formations, and east of the Antarctic Peninsula, found in the Pluto Glacier and Neptune Glacier formations.

Figure 2: Distribution of occurrences of Cretaceous ammonoid families in the west and east of the Antarctic Peninsula. Bar length indicates the temporal range of the stratigraphic unit where the taxon was found. The numbers 1, 2, and 3 indicate the number of genera found in each family in the study areas.



The Kotick Point and Pluto Glacier formations share the aconeceratid cephalopods (*Sanmartinoceras* sp.), *Phyllopachyceras* sp., *Lytoceras* sp., *Lithancylus* sp. and dimitobelid (*Tetrabelus* sp. and *Dimitobelus* sp.) and the inoceramid bivalve (*Inoceramus* sp.). The Whisky Bay and Neptune Glacier formations share the dimitobelid cephalopods (*Tetrabelus* sp. and *Dimitobelus* sp.) and *Phyllopachyceras* sp., the inoceramid (*Inoceramus* sp.) and oxytomid (*Aucellina* sp.) bivalves.

Figure 3: Distribution of occurrences of bivalve orders in the west and east of the Antarctic Peninsula. Bar length indicates the temporal range of the stratigraphic unit where the taxon was found. The numbers 1, 2, and 3 indicate the number of genera found in each family in the study areas.

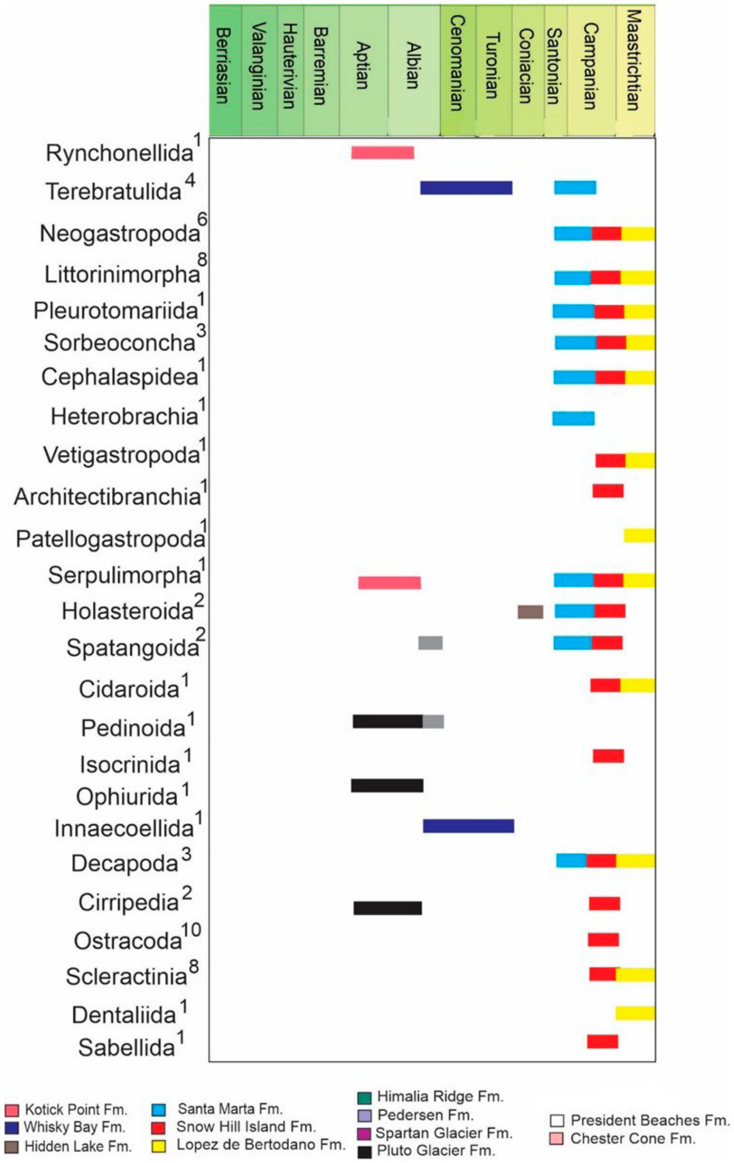


We noted that there are a greater number of taxa not shared than shared between the eastern and western portions of the Antarctic Peninsula. The genera shared by the Kotick Point and Pluto Glacier formations represent only 14% of those existing in these stratigraphic units, whereas the genera shared between the Whisky Bay and Neptune Glacier formations represent only about 10%. No shared taxa were found between the Spartan Glacier (west of the Antarctic Peninsula) and Lagrelius Point/Pedersen (east of the Antarctic Peninsula) formations. However, the small sharing of taxa between the two sides of the Antarctic Peninsula can be explained by differences in environmental conditions between Fossil Bluff and Gustav groups (see Butterworth & Macdonald, 1991; Crame et al., 2006).

This is at least partially true for Kotick Point and Pluto Glacier formations, which have a similar number of published papers and recognized taxa, albeit low and with the potential for more encounters, and possibly this small number of taxa in common can be attributed to the abyssal environment in the former and offshore in the latter (see supplementary material), as evidenced by the presence of Arthropoda and Echinoidea in the latter, during the main phase of the arc uplift and extension (Hathway, 2000; Riding

& Crame, 2002). Between Whisky Bay and Neptune Glacier, the difference between the abyssal and shoreface environment seems to influence the non-sharing of taxa, since Whisky Bay has more cephalopods and the absence of Gastropoda and Echinoidea; but clearly the difference in the number of publications (10:2) and, consequently, of recognized taxa (35:16) must also influence.

Figure 4: Distribution of occurrences of Cretaceous brachiopod, gastropod, serpulid, echinoid, crinoid, ophiuroid, porifera, arthropod, coral and scaphopod taxa in the west and east of the Antarctic Peninsula. Bar length indicates the temporal range of the stratigraphic unit where the taxon was found. The numbers 1, 2, and 3 indicate the number of genera of brachiopods, gastropods, serpulids, echinoids, crinoids, ophiuroids, porifera, arthropods, corals and scaphopods found in each family in the study areas.



As shown by the figure 5a, which correlates the geological units with the taxonomic classes of invertebrates and environments, the diversity of certain taxa is strongly influenced by the sedimentary environment. Gastropods and bivalves are more diverse in the Snow Hill Island and López de Bertodano formations which represent environments from the offshore transition to the shoreface, while cephalopods are more diverse in the Santa Marta Formation which represents offshore (above the slope; see guilds supplementary data), and Whisky Bay Formation which represents abyssal environment (see figure 5b). Stratigraphic units that represent deeper marine environments have less general invertebrate species and genera richness. Taphonomic issues may be skewing this result, but greater diversity is expected in shelf environments (*e.g.*, Kauffman, 1977; Hallam, 1987; House, 1993; Hallam & Wignall, 1999; Olivero, 2012).

However, one cannot fail to consider that the quantity of articles can also influence the registration of an apparent greater genera richness of invertebrates in one stratigraphic unit in relation to another. For example, the largest number of genera recorded in the Santa Marta, Snow Hill Island, López de Bertodano and Whisky Bay formations is also associated with a greater number of papers published on these formations, as shown in figure 5b, which correlates the geological units with the number of articles published on the various classes of invertebrates.

Figure 5: Statistical analysis of invertebrate occurrences from the Cretaceous of the Antarctic Peninsula. a - Principal Component Analysis (PCA) correlating stratigraphic units, taxa and paleoenvironments. Abbreviations: artr - arthropod, echi - echinoderm, gastr - gastropod, biv - bivalve, ceph – cephalopod, anel – annelids. Sedimentary environments: abyssal to below the slope, base of the slope, offshore (above the slope), offshore transition to shoreface. b - Principal Component Analysis (PCA) correlating stratigraphic units, taxa, papers and paleoenvironments. Abbreviations: artr - arthropod, echi - echinoderm, gastr - gastropod, biv - bivalve, ceph - cephalopod, gen - genera.

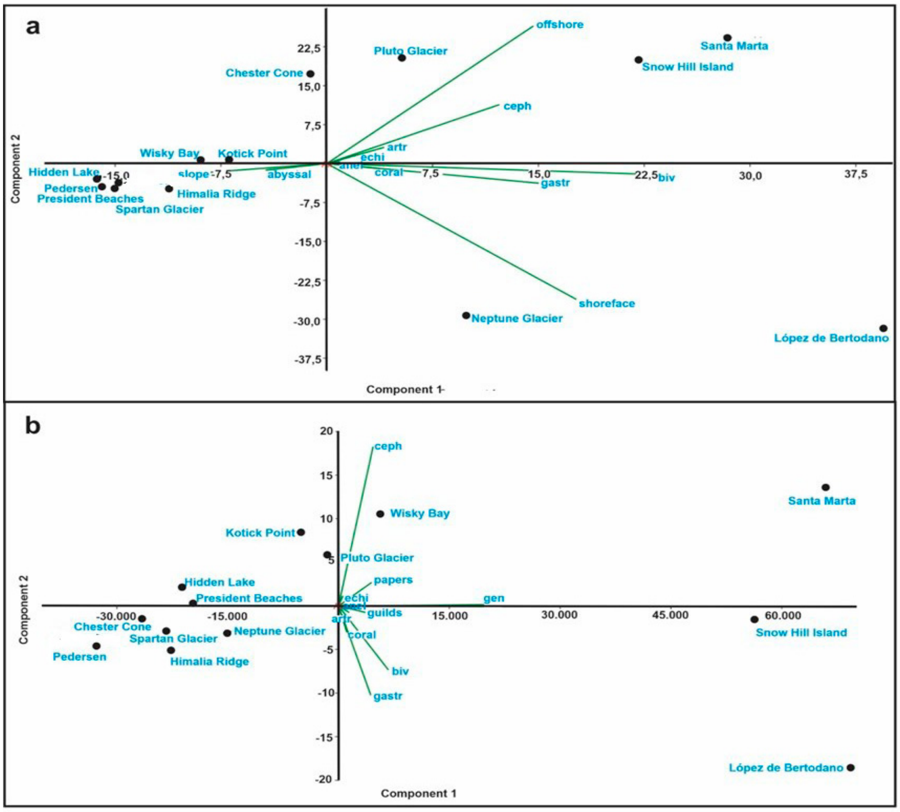
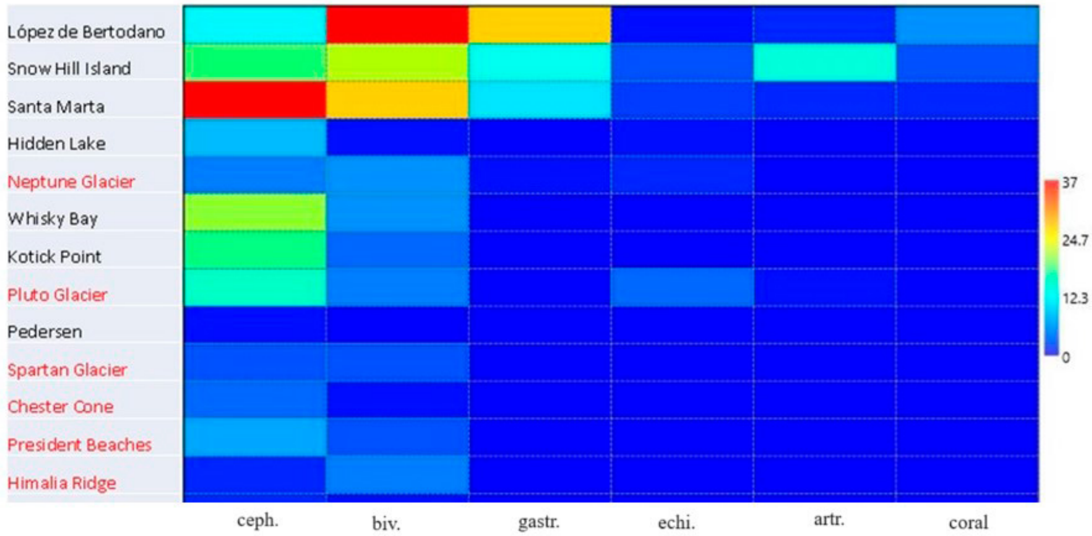


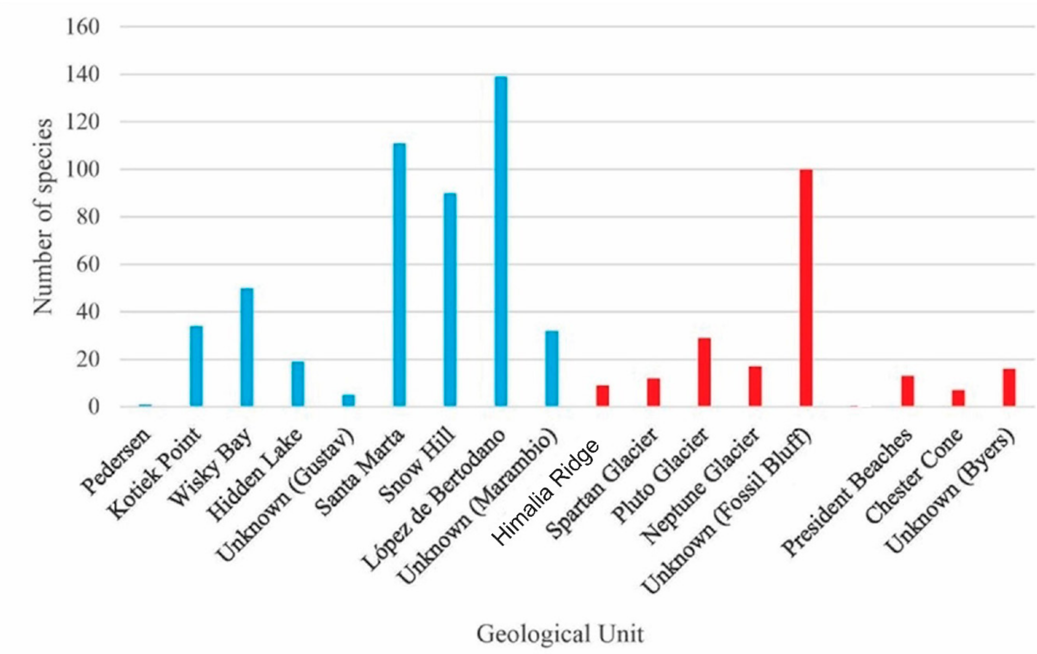
Figure 6 - Two-Way Joining Results indicating the richness (species number) of cephalopods (ceph), bivalves (biv), gastropods (gastr), corals (coral), echinoderms (echi) and arthropods (artr) in each geological formation. Names in black are from the east of the peninsula and in red from the west.



The volcanic arc represented by the Antarctic Peninsula, apparently was effective in separating different environments through the Cretaceous in Antarctica. We noticed that there was a general trend of marine regression in the basins to both sides of the Antarctic Peninsula through the Cretaceous. The forearc basins (west of the Antarctic Peninsula) went through this process earlier (from the Berriasian) than the basins of back-arc (east of the Antarctic Peninsula; from the Albian-Cenomanian). The rapid fall in relative sea level in the Alexander Island forearc sequence coincides with the transpressional event Palmer Land and deformation of the eastern Palmer Land Shear (Vaughan *et al.*, 2012; Burton-Johnson & Riley, 2015).

To the west of the Antarctic Peninsula there is a predominance of volcanic and shallow marine deposits with a tendency to regression, whereas to the east there is a predominance of deep marine deposits with a trend to transgression during the Early Cretaceous. Regarding the Late Cretaceous, there is a predominance of volcanic deposits with a trend to regression to the west and to the east there is a predominance of deep to shallow marine deposits, with a trend to regression (Bastias et al., 2019). There are few shared taxa between the fore and back-arc areas, potentially due to the different sedimentary environments on the west and east side of the peninsula at each age, as well as a few taxonomic articles and taxa recognized in some units. The marine regression influenced the diversity of invertebrate fauna in a similar way on both sides of the Antarctic Peninsula. We noticed that the stratigraphic units in the shallowest environments also have the greatest species richness. This is noticeable in the Pluto Glacier and Neptune Glacier formations, west of the Antarctic Peninsula; and in the Santa Marta, Snow Hill Island and López de Bertodano formations, in the eastern portion of the Antarctic Peninsula (figure 7).

Figure 7: Number of species per Cretaceous geological unit in Antarctica. In blue, formations east of the Antarctic Peninsula. In red, formations west of the Antarctic Peninsula.



The Berriasian Himalia Ridge and President Beaches formations, both located west of the Antarctic Peninsula, share only the bivalve *Anopea* and *Inoceramus*, but this can be explained by possible paleoenvironmental differences (see Butterworth *et al*., 1988; Hathway & Lomas, 1998). This is corroborated by the presence of the deep-water cephalopod genus *Spiticeras* (see Lukeneder, 2007) in the President Beaches Formation and the shallow-water bivalve genus *Pinna* (see Seeling & Bengtson, 2003) in the Himalia Ridge Formation.

In the eastern portion of the Antarctic Peninsula, we noticed an apparent "faunal turnover" between the Gustav and Marambio groups (after the Coniacian). Only about 29% of the genera that existed in the region before the Coniacian, are also found after the Coniacian. This apparent "faunal turnover" is possibly the result of an environmental change in this region from the Coniacian, moving from deep marine (Gustav Group) to prograding shelf (Marambio Group) (see Olivero, 2012). Since the classic work of Newell (1967), some studies have correlated changes in sea level with changes in fauna diversity (*e.g*., Hallam, 1987; Hallam & Wignall, 1999).

The increase in the general diversity of mollusks, especially bivalves and gastropods, observed by us, based on our bibliographic survey, in the east of the Antarctic Peninsula, when comparing the Gustav and Marambio groups, since the Santonian is consistent with the increase in the area of the continental shelf (diversity-area effect) in the region. Olivero (2012) observed in the López de Bertodano Formation an increase in the general diversity of macroinvertebrate fauna in transgressive facies (greater shelf area) and a decrease in regressive facies (smaller shelf area).

However, some taxa stand out for having become extinct in Antarctica earlier than in other parts of the world, regardless of the variation of the continental shelf area. This is the case of some ammonoids (scaphitids, baculitids, nostoceratids, phylloceratids), belemnites and bivalves (most trigoniids and inoceramids) (Crame et al., 1996; Olivero & Medina, 2000; Olivero, 2012). Apparently, the causes of these early extinctions are related to the cooling of waters in Antarctica between Campanian and Maastrichtian (e.g., Ditchfield et al., 1994; Huber et al., 1995; Olivero, 2012). In turn, the Kossmaticeratidae family of ammonoids possibly adapted better to colder water conditions, predominating among ammonoids in the region between Campanian and Maastrichtian but migrating to lower latitudes, when temperatures reached a magnitude that was no longer suitable for the occurrence of this family in the late Maastrichtian (Olivero & Medina, 2000; Olivero, 2012).

Based on the literature available to date, we recognize that the Marambio Group has the highest number of guilds (59), while Byers Group has the lowest (14). The only guilds recognized in all the stratigraphic groups analyzed here are "sessile epifaunal, suspensivorous," composed predominantly by bivalves and subordinately by brachiopods, annelids, crinoids, bryozoans, porifera, corals; and "carnivorous nektonic," composed essentially of cephalopods. Here again, the difference in the number of papers is largely responsible for these figures. However, it is possible that the more extensive platform environments at a stable tectonic moment in the upper Cretaceous may be expanding the habitat areas and stability of the environments in the back-arc basin, when compared to the forearc basin, accounting for this enormous difference. Most recognized guilds are composed of epifaunal or nektonic animals and subordinately there are deep infaunal to semi-infaunal invertebrate guilds.

There is an expansion in the number of guilds between the Gustav and Marambio groups (east of the Antarctic Peninsula), passing from a deep marine environment to a phase of shelf expansion (Olivero, 2012) that occurred from the Santonian, generating an increase in the faunal variety and the occupation of this prograding shelf.

During the transgressive-regressive cycles that occurred at the end of the Cretaceous, several faunal groups underwent changes in diversity patterns, such as the ammonoids that showed a decrease in their generic diversity (from about 20 in the early Campanian to less than 10 in the late Maastrichtian) due to changing conditions in the water mass, or as the inoceramids and some trigonids disappearing from Antarctica during the early Campanian (Olivero, 2012).

The maximum diversity in this environment is controlled by the transgression peak during shelf widening. There was a rapid increase in epifaunal and infaunal animals, infauna is the most important guild in the Cretaceous. The spectrum of guilds is relatively broad on the finer-grained shallow shelf (Aberhan, 1994). It is possible that from Santonian the life environments on the shelf have reached an optimal environment favorable to the expansion of guilds.

At the beginning of the Cretaceous the Fossil Bluff Group shows a significant establishment of guilds, mainly epifaunal organisms and subordinate infaunal organisms that occupied deep outer areas to shallow regions. Bivalves are dominant and represent conditions of high energy, shallow environments, and a fauna capable of moving in unstable sediments (Butterworth et al., 1988). However, the diversity is nowhere near that of the Marambio Group's offshore and shoreface environments, perhaps due to the less extensive platforms established in the forearc, not to mention the much smaller number of papers. The analysis of the guild recognized here must be done with caution, considering the different environments that the four groups (Fossil Bluff, Byers, Gustav and Marambio) represent and the scarcity of studies, especially in the Byers Group. Furthermore, these analyzes are generalizations that need to be refined with further studies with stratigraphic control and taphonomy in all geological units. There are no taphonomic studies, which consider taxonomic identification in Antarctica, and stratigraphic ties are not quite common. Therefore, a more detailed analysis of them is necessary with the objective of characterizing the faunal assemblages distributed in the specific paleoenvironments for each geological unit, relating the defined guilds with modern analogues to determine a possible set of paleoenvironmental and palaeoecological conditions, taking into account parameters such as salinity, oxygen, substrate, energy level, among others to structure the paleocommunities of this geological period. It is also necessary to better stratigraphic control of the occurrence of specimens as well as taphonomic studies and, using all this information, paleoenvironmental reconstruction. These are some of the possibilities for deepening paleoenvironmental and palaeoecological analysis in the Cretaceous of Antarctica.

Although the fossils representing certain species may be allochthonous and these species could not all live in the same environment, the relative richness of species and life habits per geological unit allows us to glimpse, in a preliminary way, the diversity and complexity of the Cretaceous communities of the Antarctic Peninsula. Close *et al.* (2020) indicated a slightly increase in global marine fauna diversity during the Cretaceous but they did not use high paleolatitude data for this period and Antarctica was already situated at high latitudes during the Cretaceous (see Boucot et al., 2013).

CONCLUSION

In the Marambio, Gustav, Fossil Bluff and Byers groups, the most well-known invertebrates are cephalopods (ammonoids and belemnites) and bivalves. We also identified that the Marambio Group presents the greatest diversity recorded in the Antarctic Cretaceous, possibly it is better studied and also possibly because the paleoenvironment of offshore and shoreface is more conducive to greater faunal diversity, as well as having been deposited in back-arc basins, which are larger and therefore have more habitats available, at a time of greater tectonic stability. The offshore and shoreface environments are also those that showed the greatest diversity in the east of the Peninsula (Fossil Bluff Group), but with less diversity in relation to Marambio Group, which must be related to: the lower number of papers; the time of greatest arc uplift of the magmatic arc, contributing to less stability in the environments; and the less extensive marine platforms of the forearc basins. The upward trend in richness is accompanied by an increase in ecosystem complexity, as evidenced by an increase in the number of guilds. We realized that the number of guilds in the geological units generally follows the increase in species richness, tending to increase in the shallower shelf environments both in the west and in the east of the Antarctic Peninsula.

In this paper we tried to compare the fauna of the four groups of the Antarctic Cretaceous, however this type of analysis is difficult, due to the incompleteness of the geological record and mainly due to the environmental difference represented by these groups. The volcanic arc, represented by the Antarctic Peninsula, separated different environments to the east and west but on both sides of the Antarctic Peninsula we have noticed that there is an increase trend for invertebrate diversity as the environment becomes shallower. The only groups that could be compared, because they were deposited at the same age, were the base of the Byers Group and the Fossil Bluff Group. In the various formations we noticed a very low sharing of genera between the east and west sides of the peninsula, which may be associated with geographical isolation, accentuated by the different environments in which they were deposited (abyssal for slope on the west side and shoreface for offshore on the east side). In addition, the smaller number of articles conducted on the east side may also be influencing this.

We conclude that there are few studies correlating variation in faunal diversity with environmental changes in the Antarctic Cretaceous (*e.g.*, Crame et al., 1996; Olivero, 2012). Collections with more refined stratigraphic control of the taxa also need to be conducted in all the geological units. Therefore, we recommend that more works on this topic be conducted, to better understand the evolution of fauna in Antarctica, correlating with possible variations in the sea level, water temperature and water oxygenation.

Finally, we also recommend that more fieldwork and taxonomic studies be done mainly in the Fossil Bluff and Byers groups and in the possible Berriasian of the Nordenskjöld Formation (east of the Antarctic Peninsula) (see Whitham & Doyle, 1989; Kietzmann & Scasso, 2020).

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SUPPLEMENTARY DATA

Table I. Fossil invertebrates recorded in the Gustav Group (Howarth, 1966; Medina et al., 1982; Crame, 1983; Doyle, 1985; Ineson et al., 1986; Olivero & Palamarczuk, 1987; Doyle, 1990; Sandy, 1991; Medina et al., 1992; Medina & Buatois, 1992; Crame et al., 1996; Hathway & Riding, 2001; Kennedy et al., 2007; Vodrážka & Crame, 2011; Schweitzer et al., 2012). *Names spelled according to the original works.

FORMATION	PHYLUM/ CLASS	SPECIES*
PEDERSEN FM.	Cephalopoda	*Favrella wilckensi*
KOTICK POINT FM.	Bivalvia	"*Anopaea*" sp., *Aucellina* cf. *andina*, *Inoceramus* cf. *sutherlandi*, *Inoceramus stoneleyi*, *Maccoyella* sp., ?*Sphaera striata*
	Cephalopoda	*Acanthohoplites* sp., *Anagaudryceras sacya*, *Belemnopsis* sp., *Beudanticeras* sp., *Kossmaticeras meseticum* (=*Bonarelliceras meseticum*), *Cymatoceras* cf. *virgatus*, *Dimitobelus* cf. *stimulus* var. *extremis*, *Dimitobelus* cf. *superstes*, *Dimitobelus* (*Dimitobelus*) *stimulus*, *Dimitobelus praelindsayi*, "*Lithancylus*" cf. *guanacoense*, *Lytoceras* sp., *Peltocrioceras* sp., *Phyllopachyceras* sp., "*Pseudothurmannia*" cf. *mortilleti*, *Ptychoceras* sp., *Sanmartinoceras* sp., *Silesites* aff. *antarcticus*, *Silesites desmoceratoides*, *Dimitobelus* (*Tetrabelus*) *seclusus*, *Dimitobelus* (*Tetrabelus*) sp., *Tetragonites heterosulcatus*, *Lytoceras timotheanus* (=*Tetragonites timotheanus*), cf. "*Wellmanites*" *zelandicus*
	Gastropoda	Aporrhaidae indet.
	Brachiopoda	*Lamellaerynchia* sp.
	Annelida	*Rotularia calosa*
	Echinodermata	Echinodermata indet.
WHISKY BAY FM.	Bivalvia	"*Anopaea*" sp., *Aucellina* cf. *hughendenensis*, "*Birostrina*" *concentrica*, *Entolium* sp., *Eriphyla* sp., *Inoceramus* (*Actinoceramus*) *concentricus*, *Inoceramus carsoni*, *Inoceramus pictus*, *Inoceramus stonelyi*, *Tethynoceramus madagascariensis*
	Cephalopoda	*Anagaudryceras sacya*, *Calycoceras* sp., *Desmoceras* aff. *latidorsatum*, *Desmoceras* sp., *Dimitobelus* cf. *dayi*, *Dimitobelus* (*Dimitobelus*) cf. *superstes*, *Dimitobelus* (*Dimitobelus*) *stimulus*, *Dimitobelus diptycha*, *Dimitobelus* (*Tetrabelus*) sp., *Gaudryceras* cf. *stefaninii*, *Gaudryceras* (*Gaudryceras*) *strictum*, *Gaudryceras* sp., *Helicancylus patagonicum*, *Hysteroceras* aff. *orbignyi*, *Kossmaticeras* (*Kossmaticeras*) aff. *sakondryense*, *Kossmaticeras* sp., ?*Labeceras* sp., *Lechites* sp., *Mariella* sp., ?*Marshallites* sp., "*Newboldiceras*" sp., ?*Pachydesmoceras* sp., "*Parahibolites*" *blanfordi*, *Phyllopachyceras* sp., *Pseudouhligella* sp., *Pseudoxybeloceras* sp., *Ptychoceras* sp., *Sciponoceras* sp., *Silesites* aff. *antarcticus*, *Dimitobelus* (*Tetrabelus*) *seclusus*, *Dimitobelus* (*Tetrabelus*) *whitehousei*
	Gastropoda	Naticidae indet., Pleurotomariidae indet.
	Brachiopoda	?*Cretirhynchia* sp., *Kingena* sp., ?*Ptilorhynchia australis*, *Recthyris whiskyi*, *Terebratella* sp., *Terebratula* sp.
	Porifera	*Laocoetis piserai*
HIDDEN LAKE FM.	Bivalvia	*Inoceramus africanus* (=*Mytiloides africanus*), *Inoceramus australis*, *Inoceramus neocaledonicus*
	Cephalopoda	*Baculites cazadorianus*, *Baculites* sp., *Dimitobelus* cf. *ongleyi*, *Eubostrychoceras* sp., *Eupachydiscus macoveii*, *Eupachydiscus* sp., *Gaudryceras* (*Gaudryceras*) *strictum*, *Gaudryceras* sp., *Menuites* (*Neopachydiscus*) *hauthalli*, *Menuites* (*Neopachydiscus*) sp., *Menuites* (*Neopachydiscus*) *steinmanni*, *Menuites patagonicus*, *Peroniceras* sp., *Pseudoxybeloceras* sp., *Lytoceras epigonus* (=*Tetragonites epigonus*)
	Echinodermata	*Giraliaster* sp.

Continue

Conclusion

FORMATION	PHYLUM/CLASS	SPECIES*
	Arthropoda	*Hadrocarcinus tectilacus,*
UNKNOWN FORMATION	Gastropoda	Aporrhaidae indet.
	Bivalvia	*Aucellina andina-radiaostriata, Inoceramus neocomiensis*
	Annelida	*Rotularia calosa*
	Bryozoa	Bryozoa indet.

Table II. Fossil invertebrates recorded in the Marambio Group (Weller, 1903, Kilian & Reboul, 1909; Felix, 1909; Lambert, 1910; Wilckens, 1910; 1911; Spath, 1953; Howarth, 1958; Ball, 1960; Fleet, 1966; Del Valle & Rinaldi, 1975; Owen, 1980; Medina & Del Valle, 1980; Del Valle et al., 1982; Macellari, 1984; Olivero, 1984; Medina & Del Valle, 1985; Macellari, 1986; Olivero et al., 1986; Stilwell & Zinsmeister, 1987; Macellari, 1988; Olivero, 1988; Tshudy & Feldmann, 1988; Lirio et al., 1989; Olivero & Zinsmeister, 1989; Urreta, 1989; Zinsmeister et al., 1989; Doyle, 1990; Scasso et al., 1991; Sandy, 1991; Askin et al., 1991; Aguirre-Urreta & Olivero, 1992; Feldmann et al., 1993; Darrel & Taylor, 1993; Filkorn, 1994; Zinsmeister & Griffin, 1995; Crame et al., 1996; Olenik & Zinsmeister, 1996; Stilwell, 1999; Néraudeau et al., 2000; Stilwell & Zinsmeister, 2002; Stilwell, 2002; Fauth et al., 2003; Stilwell & Zinsmeister, 2003; Crame et al., 2004; Stilwell et al., 2004; Cichowolski et al., 2005; Olivero, 2007; Beu, 2009; Harasewych et al., 2009; Olivero, 2012a; b; Schweitzer et al., 2012; Klompmaker, 2013; Crame et al., 2014; Witts et al., 2015; 2016; Raffi & Olivero, 2016; Olivero & Raffi, 2018; Tobin et al., 2018; 2020; Raffi et al., 2019; Videira-Santos et al., 2020; Pinheiro et al., 2020; Videira-Santos et al., 2022, Luther unpublished data). *Names spelled according to the original works.

FORMATION	PHYLUM/ CLASS	SPECIES*
SANTA MARTA FM.	Cephalopoda	*"Ainoceras zinsmeisteri", Anagaudryceras calabozoi, "Anapachydiscus constrictus", "Anapachydiscus"* sp., *Baculites bailyi, Baculites cazadorianus, Baculites kirki, Baculites rectus, Baculites subanceps, "Caledonites validus", Damesites* cf. *hetonaiesis, Dimitobelus* cf. *seymourensis, Dimitobelus* (*Dimitobelus*) *ongleyi, Dimitobelus* (*Dimitocamax*) *cramensis, Diplomoceras cylindraceum, Eubostrychoceras* aff. *elongatum, Eubostrychoceras medinai, Eupachydiscus paucituberculatus, Eutrephoceras antarcticum, Nautilus dorbignyanus* (=*Eutrephoceras dorbignyanum*), *Gaudryceras brandyense, Gaudryceras* cf. *strictum, Gaudryceras* (*Gaudryceras*) *strictum, Gaudryceras santamartense, Gaudryceras* sp., *Gaudryceras submurdochi, "Grossouvrites occultus", Hauericeras* sp., *Hoplitoplacenticeras* sp., *Kitchinites angolaensis, Kitchinites* cf. *japonica, Kitchnites* sp., *Kossmaticeras* (*Karapadites*) aff. *centinelaensis, Maorites* sp., *Menuites hauthali, Menuites steinmanni, Metaplacenticeras* cf. *subtillistratum, Kossmaticeras* (*Natalites*) cf. *hauthali, Kossmaticeras* (*Natalites*) cf. *morenoi, Kossmaticeras* (*Natalites*) *rossensis, Kossmaticeras* (*Natalites*) *taylori, Neograhamites* aff. *morenoi, Neograhamites kiliani, Neograhamites taylori, "Neokossmaticeras" redondensis, Neophylloceras* sp., *Parasolenoceras* sp., *Placenticeras* sp., *Polyptychoceras* aff. *obstrictum, Pseudophyllites* sp., *Pseudoxybeloceras lineatum, Pseudoxybeloceras* sp., ?*Pseudophyllites* cf. *latus, "Ryugasella" antarctica, Scalarites* sp., *Scaphites* sp., *Tetragonites* sp., *"Vertebrites"* sp., *Yezoites sp., Zelandites pujato*i
	Bivalvia	*"Antarcticeramus' rabotensis, Austrotrigonia oliveroi, Cinulia* sp., *Corbula* sp., *Cucullaea* sp., *"Cyclorisma"* sp., *Entolium* sp. *Eriphyla* sp., *Eselaevitrigonia* sp., *Goniomya* sp., *Inoceramus australis, Inoceramus neocaledonicus, Lahillia* sp., *Lima* sp., *Limatula* sp., *"Lucina"* sp., *Modiolus* sp., *Neilo* sp., *Nipotrigonia* sp., *Nucula* sp., *Oistotrigonia* sp., *Pacitrigonia* sp., *Panopea* sp., *Pholadomya* sp., *Pinna* sp., *Haumurigonia malagninoi* (=*Pterotrigonia* (*Pterotrigonia*) *malagnoi*), *Haumurigonia spikermanni* (=*Pterotrigonia* (*Rinetrigonia*) *spikermanni*), *Thracia* sp.
	Gastropoda	*Aporhais* sp., *Cerithium* sp., *Eunaticina* sp., *"Natica"* sp., *"Nerinea"* sp., *"Pleurotomaria"* sp., *Scaphander* sp., *Taioma* sp., *Terebra* sp., *Triton* sp., *Turritella* sp.

Continue

FORMATION	PHYLUM/ CLASS	SPECIES*
	Scaphopoda	Dentallida indet.
	Brachiopoda	*Capillithyris* sp., *Magas* cf. *mesembrina* (=*Kingena* cf. *mesembrina*)
	Annelida	*Rotularia* sp.
	Arthropoda	*Calianassa meridionalis, Hoploparia echinata, Hoploparia stokesi, Hoploparia antarctica, Hadrocarcinus carinatus, Hadrocarcinus wrighti, Torynomma (Torynomma) australis, Cristafrons praescientis, Plagiophthalmous collinsi, Retrorsichela laevis, Munldopsis foersteri, Paguristes santamartaensis, Llnuparus macellari, Glyphea australensis, Metanephrops jenkinsi, , Metanephrops rossensi, Notiodromia australis*
	Echinodermata	*Huttonechinus antarctica, Micraster* aff. *regularis,* e ?*Nordenskjoeldaster australis*
	Anthozoa	Caryophylliidae indet., *Dasmosmilia*? sp., *Heterocyathus filkorni*
SNOW HILL ISLAND FM.	Cephalopoda	*Anagaudryceras sanctuarium, Anagaudryceras* sp., *Anagaudryceras subcompressum, "Anapachydiscus"* sp., *Astreptoceras* sp., *Baculites delvallei, Cymatoceras* sp., *Diplomoceras cylindraceum, Eupachydiscus* sp., *Gaudryceras* cf. *mite, Gaudryceras rabotense, "Grossouvrites"* sp., *Gunnarites antarcticus, Jacobites anderssoni, Jacobites crofti, ?Jimboiceras antarcticum, Maorites seymourianus, "Natalites"* sp., *Neograhamites* cf. *kiliani, Neograhamites primus, Phyllopachyceras* sp., *Polyptychoceras* sp., *Pseudophyllites* sp., *Tetragonites* sp.
	Bivalvia	*Conchocele townsendi* (=*Lucina townsendi* and *Thyasira townsendi*), *Corbula* sp., *Cucullaea* sp., *"Cyclorisma"* sp., *Entolium seymouriensis, Eriphyla* sp., *Eslavitrigonia regina, Lahillia* sp., *Lima* sp., *Limatula* sp., *"Lucina"* sp., *Modiolus* sp., *Neilo* sp., *Nordenskjoldia* sp., *Oistotrigonia* sp., *Pacitrigonia* sp., *Panopea* sp., *Pinna anderssoni, Pinna* sp., *Pycnodonte* (*Phygraea*) *vesicularis, Solemya* sp., *Thracia* sp., *Thracia askinae, Trigonia* sp.
	Gastropoda	*Amberleya* sp., *Aporrhais* sp., *Eudolium mirabilis* (=*Casidaria mirabilis*), *Cinulia* sp., *Eunaticina* sp., *"Natica"* sp., *Perissoptera* sp., *"Pleurotomaria"* sp., *Scaphander sp.,* ?*Perissoptera nordenskjoldi* (=/ *Struthiochenopus nordenskjoldi*), *Taioma* sp., *Charonia* sp. (= *Triton* sp.), *Turritella* sp.
	Scaphopoda	cf. *"Eodentalium grandis"*, ?*Laevidentalium* sp.
	Echinodermata	*Cyathocidaris* sp., *Giraliaster lorioli, Hemiaster vomer, "Isselicrinus antarcticus".*
	Anthozoa	?*Astreopora* sp., ?*Parasmilia andersoni* (=?*Flabellum andersoni*), *Cycloseris deltoidophora* (= *Fungiacyathus deltoidophorus*), ?*Pleurocora haueri* (= ?*Oculina nordenskjoeldi*), Scleractinia indet.
	Arthropoda	?*Argilloecia* sp., *Bairdia* sp., *Brythocypris* sp., *"Cytherella"* sp., *Cytherelloidea megaspirocostata, Cytheropteron* sp., *Eocytheropteron carinoalatum, Euscalpellum antarticum, Hoploparia* sp., *Mandelstamia antarctica, Manjugaella australis, Paguristes* sp., *Paracypris* sp., *Rostrocytheroidea hamitonensis*
	Annelida	*Ditrupa varicosa, Rotularia* (*Australorotularia*) *calosa, Rotularia* (*Rotularia*) *dorsolaevis,*
LÓPEZ DE BERTODANO FM.	Cephalopoda	*Anagaudryceras seymouriense* (= *Graudryceras seymouriense*), *Anapachydiscus* sp., *Diplomoceras cylindraceum* (= *Diplomoceras lambi*), *Nautilus dorbgnyanum,* (= *Eutrephoceras dorbignyanum*), *Kossmaticeras gemmatus* (= *Grossouvrites gemmatus*), *Kossmaticeras johare* (*Grossouvrites joharae*), *Gunnarites antarcticus, Gunnarites bhavaniformis, Jacobites crofti, Kitchinites darwini, Kitchinites laurae, Maorites densicostatus, Maorites seymourianus,* ?*Maorites* sp., *Maorites tuberculatus, Maorites weddelliensis, Pachydiscus ootacodensis, Pachydiscus* (*Pachydiscus*) *ultimus, Pachydiscus riccardii, Pseudophyllites loryi, Anagaudryceras varuna* (= *Zealandites varuna*)

Continue

Conclusion

FORMATION	PHYLUM/ CLASS	SPECIES*
	Bivalvia	*Acesta shackletoni, Acesta snowhillensis, Acesta webbi, Austrocucullaea oliveroi, Cucullaea antarctica, Cucullaea ellioti, Cyclorisma chaneyi, ?Cyclorisma* sp., *Cyclorismina/Marwickia* sp., *"Dozyia dryqalskiana", Entolium sadleri, Entolium seymouriensis, Entolium* sp., *Eriphyla* sp., *Eselaevitrigonia regina, Euspira? sp., Goniomya hyriformis, Cyprina larseni* (= *Lahillia larseni*), *Dozyia drygalskiana, Jupiteria*? sp., *"Lahillia* sp.*", Limopsis* (*Limopsis*) *antarctica, Leionucula suboblonga* (= *Nucula (Leionucula) suboblonga*), *Limatula* sp., *Linotrigonia pygoscelium, Lucina scotti, Modiolus pontotocensis, Neilo gracilis* (= *Malletia gracilis* and *Australoneilo gracillis*), *Neilo casei, Nordenskjoldia nordenskjoldi, Oistotrigonia pygoscelium, ?Parathyasira austrosulca, Panopea clausa, Phelopteria feldmanni, Phelopteria* sp., *Pholadomya gracilis, Pinna anderssoni, Pinna freneixae, Pinna* sp., *Pulvinies antarctica, Pycnodonte* (*Phygraea*) *vesicularis vesicularis* (= *"Pycnodonte* (*Phygraea*) *vesiculosum", "Pycnodonte* (*Pycnodonte*) *vesiculosum"* and *Pycnodonte seymourianus*), *Pulvinites antarctica, Seymoutula antarctica* (= *Lima antarctica*), *"Saxolucina"* sp., *Solemya rossiana, Sorobula nucleus, Thracia* sp., *Thracia askinae*
	Gastropoda	*Tectura* (= *Acmaea* sp.), *Acteon* (*Tenuiactaeon*) *antarctihadrum, "Amberleya" spinigera, "Antarctissitys austrodema", "Austroaporrhais larseni", "Austroaporrhais stilwelli", Austrosphaera bulloides* (= *Seymourosphaera bulloide* and *Austrosphaera patagonica*), *Austrosphaera elevata* (= *Seymourosphaera elevata*), *Eudolium mirabilis* (= *Cassidaria mirabilis*), *Cerithium* sp., *"Colus" delrioae, Cryptorhytis phillipiana, Eunaticina arctowskiana, Fusinus phillippiana, Fusinus* sp., *Exilia* cf. *culbertoni* (=*Graphidula* cf. *culbertoni*), *Heteroterma* sp. (=*Heterotrema* sp.), *Haustator*? sp., *Leptomaria* cf. *seymouriensis, Leptomaria antipodensis, Leptomaria hickmanae, Mesalia* sp., *"Oligoptycha* cf. *O. concinna", Perissoptera nordenskjoldi, Perisodonta austerocallosa, Pleurotomaria larseniana, Scaphander* sp., *Struthiochenopus antarcticus, Struthiochenopus hurleyi, Struthiochenopus nordenskjoldi, Trachytriton* sp., *Taioma charcotianus, Taioma* sp., *Littorina* (sensu lato) *arktowskiana* (= *"Vanikoropsis" arktowskiana*), Neogastropod, n. gen. A
	Scaphopoda	*Dentalium* sp., *Laevidentalium wilckensi*
	Anthozoa	*Alvelocyathus nordenskjoldi, Bothrophoria ornata, Conocyathus felixi* (=*Laminocyathus wellsi*), *Cycloseris deltoidophora* (= *Fungiacyathus deltoidophorus*), *Wellsotrochus cyathiformis* (= *Levicyathus cairnsi*), *Palocyathus seymourensis, Platytrochus vaughani* (= *Tropidocyathus minimus, Tropidocyathus seymourensis)*
	Annelida	*Rotularia dorsolaevis, Rotularia fallax, Rotularia shackletoni, Rotularia tenuilaevis, Rotularia zinsmeisteri*
	Echinodermata	*Cyathocidaris nordenskjoldi, Cyathocidaris patera*
	Arthropoda	*Callianassa meridionalis Hoploparia stokesi, Hadrocarcinus wrighti, Cristafrons praescientis, Rhinopoupinia bicornis, Meyeria croffi, Glyphea australensis*
UNKNOWN FORMATION	Cephalopoda	*Gaudryceras* cf. *crassicostatum, Gaudryceras proemite, Gunnarites flexuosus, Gunnarites gunnari, Gunnarites kalika, Gunnarites pachys, Gunnarites paucinodatus, Gunnarites rotundus, Hoploscaphites quiriquinensis, Neophylloceras hetonainse, Neophylloceras, meridianum, Parapuzosia* sp., *Patagiosites* aff. *amarus, Phyllopachyceras forbesianum, Phylloptychoceras zelandicum, Pseudophyllites peregrinus, Saghalinites cala*
	Bivalvia	*Cucculaea grahamensis, Cytherea antarctica, Homomya rinaldii, Lahiilia* (*Lahiilia*) *luisa, ?Phelopteria* sp., *Pholadomya gracillis*
	Gastropoda	*Lagena*? *antartica, Taioma globus, Tubulostium callosum*
	Annelida	*Serpula* sp.
	Brachiopoda	*Protegulorhynchia meridionalis, Rossithyris humpensis, "Terebratella"* sp., *"Terebratula"* sp., *Terebratulina* sp.

Table III. Fossil invertebrates recorded in the Fossil Bluff Group (Cox, 1953; Howarth, 1958; Taylor, 1965; 1966; Thomson, 1971; 1972a;1972b; Thomson & Wiley, 1972; Wiley, 1973; Thomson, 1974; Willey, 1975a; b; c; Thomson, 1979; Thomson & Owen, 1979; Taylor, 1979; Collins, 1980; Thomson, 1983; Crame, 1983; 1985; Butterworth et al., 1988; Crame & Howlett, 1988; Urreta, 1989; Kelly & Moncrieff, 1992; Kelly, 1995; Crame & Kelly, 1995; Crame, 1996; Smith & Crame, 2012). *Names spelled according to the original works.

FORMATION	PHYLUM/ CLASS	SPECIES*
HIMALIA RIDGE FM.Z	Bivalvia	*Anopaea calistoensis, Grammatodon* sp., *Inoceramus* sp., *Myophorella* sp., *Pinna* sp, *Pholadomya* sp.
	Cephalopoda	*Haplophylloceras* sp., "*Raimondiceras*" sp.
SPARTAN GLACIER FM.	Bivalvia	"*Anopaea*" sp., *Aucellina caucasia-aptiensis, Aucellina radiatrostriata, Aucellina* sp., *Inoceramus deltoides, Inoceramus* sp., *Parainoceramus* sp.
	Cephalopoda	*Belemnopsis alexandri, Belemnopsis gladiatoris,* cf. *Belemnopsis madagascariensis, Bochianites* sp., *Olcostephanus* sp., *Sanmartinoceras* sp.
PLUTO GLACIER FM.	Bivalvia	*Arcinella* sp., *Cuspidaria* sp, *Entolium* sp., *Inoceramus* sp., *Pinna* sp., *Thracia* sp.
	Cephalopoda	*Aconeceras* sp., "*Antarcticoceras*" sp., *Dimitobelus* sp., "*Emericiceras*" sp., "*Eulytoceras*" sp., *Helicancylus patagonicus*, "*Hypophylloceras*" sp., "*Lithancylus*" sp., *Lytoceras* sp., "*Neosilesites*" sp., "*Peratobelus*" *oxys, Phylloceras* sp., *Phyllopachyceras* sp., *Sanmartinoceras* sp., *Dimitobelus* (*Tetrabelus*) *willyi*, ?*Tropaeum* sp.
	Brachiopoda	*Penzhinothyris imbricata*
	Arthropoda	*Pycnolepas articulata*
	Echinodermata	*Australidiadema alexandri, Hemipedina taylori, Mesophiomusium paragraysonensis, Notidisaster subitus,* ?*Ophiacantha* sp.
NEPTUNE GLACIER FM.	Bivalvia	*Aucellina* sp., *Eslaevitrigonia* sp., *Inoceramus* sp., *Nototrigonia* sp., *Pacitrigonia* sp., *Panopea* sp., *Pterotrigonia* sp.
	Cephalopoda	*Aconeceras* sp., "*Antarcticoceras*" sp., *Dimitobelus* sp., "*Eulytoceras*" sp., *Lytoceras* sp., *Phyllopachyceras* sp., *Dimitobelus* (*Tetrabelus*) sp.
	Gastropoda	?*Vanikoropsis* sp.
	Echinodermata	*Hemiaster* cf. *zululandensis, Hemipedina taylori*
UNKNOWN FORMATION	Bivalvia	*Anopaea* cf. *mandíbula, Anopaea trapezoidalis, Aucellina andina-radiatostriata, Buchia* sp., *Cyprina* sp., *Grammatodon* (*Indogrammatodon*) cf. *robusta, Grammatodon* (*Nanonavis) falcatus, Grammatodon* (*Nanonavis*) *alexandra, Grammatodon* (*Indogrammatodon*) aff. *fyfei, Grammatodon subrectangulus, Grammatodon* (*Indogrammatodon*) *antarctica, Inoceramus anglicus, Inoceramus neocomiensis, Inoceramus ovatus, Myophorella alexandra, Pecten* cf. *argentinus, Pinna kotsinensis, Pinna antarctica, Pinna* cf. *robinaldina, Praeaucellina* sp., ?*Sphaera striata, Thracia* sp.
	Cephalopoda	*Aconeceras* aff. *nisoides,* ?*Acrioceras* aff. *voyanum, Acrioceras* sp., *Ancyloceras patagonicum, Ancyloceras* sp., *Antarcticoceras antarcticum, Bochianites gracilis, Belemnopsis gladiatoris, Belemnopsis alexandri, Belemnopsis* aff. *uhligi,* ?*Callizoniceras* sp., ?*Costidiscus* sp., ?*Emericiceras* sp., ?*Eotetratgonites, Eotetragonites* sp., *Eulytoceras* aff. *polare, Hamites* sp., ?*Hemihoplites* sp., *Himalayites* sp., ?*Hypophylloceras, Hibolites antarctica, Hibolites subfusiformis, Hibolites* cf. *compressus, Hibolites* aff. *marwicki mangaoraensis, Lechites* sp., ?*Lithancylus* sp., *Lytoceras* sp., ?*Macroscaphites* sp., *Neocosmoceras* aff. *sayni, Neocosmoceras* sp., *Neohibolites* cf. *miyakoensis, Neohibolites minimus* cf. var. *submedius, Neohibolites minimus* cf. var. *oblongus, Phylloceras* sp., *Phyllopachyceras aureliae, Phyllopachyceras* cf. *baborense, Pseudothurmannia* sp., *Pseuthurmannia* cf. *mortilleti, Ptychoceras* sp., *Sanmartinoceras patagonicum, Sanmartinoceras* (*Theganeceras*) *grande, Sarasinella* aff. *hondana, Sarasinella* sp., *Silesites* aff. *vulpes, Silesites antarcticus,* ?*Silesites desmoceratoides, Silesites* sp., *Spiticeras* sp., ?*Substreblites, Substreblites* sp., *Toxoceratoides* sp.

Continue

Conclusion

FORMATION	PHYLUM/ CLASS	SPECIES*
	Gastropoda	*Amphitrochus* sp., *Anchura* sp., *Aporrhais* (*Tessarolax*) *antarctica*, *Procerithium* sp., *Proscala* sp., *Rissoina* sp., *Turriscala* sp., *Turritella* sp.
	Annelida	*Rotularia australis*
	Brachiopoda	*Acanthorynchia* sp., *Discina* sp., *Lamellarhynchia* sp., *Lingula* sp., *Prochlidonophora* sp., *Ptilorynchia* sp., *Terebratula lamelosa*
	Echinodermata	*Anorthopygus* sp., *Epiaster* sp., *Isocrinus* sp., *Rhabdocidaris* sp.
	Arthropoda	*Brachyzapfes* sp., *Cretiscalpellum* sp., *Enoploclytia* sp., *Glyphea* sp., *Mecochirus* sp., *Palaeastacus* sp., *Protocallinassa* sp., *Sclueteria* sp., *Trachysoma* sp.

Table IV. Fossil invertebrates registered in the Byers Group (Covacevich, 1976; Smellie et al., 1980; Crame et al., 1993; Crame, 1995; Kelly, 1995; Crame & Kelly, 1995; Israel unpublished data, Dochev et al., 2017). *Names spelled according to the original works.

FORMATION	PHYLUM/ CLASS	SPECIES*
	Bivalvia	*Retroceradamus haasti*
PRESIDENT BEACHES FM.	Cephalopoda	*Antarctiteuthis donovani, Perisphinctes loncochesis* (= *Argentiniceras lonchochense*), *Blanfordiceras* sp., *Bochianites* sp., *Himalyites* sp., *Spiticeras bilobatum, Spiticeras (Spiticeras) spitiensis, Ammonites tripartium* (= *Spiticeras tripartium*)
	Bivalvia	*Anopaea* sp. nov?. *Inoceramus* sp., *Manticula complanata,* "*Praeaucellina*" *umbonoradiata, Pterotrigonia* (*Pterotrigonia*) aff. *rogersi* (Kitchin, 1908)
CHESTER CONE FM.	Bivalvia	"*Praeaucellina*" *umbonoradiata*
	Cephalopoda	*Belemnopsis* (*Belemnopsis*) *alexandri, Belemnopsis* (*Belemnopsis*) *gladiatoris, Bochianites* sp., *Neocomites* sp., ?*Olcostephanus* cf. *atherstoni, Uhligites* sp.
UNKNOWN FORMATION	Cephalopoda	*Berriasella* sp., *Bochianites* aff. *gerardi, Bochianites* aff. *glaber, Haplophylloceras strigile, Neocomites neocomiensis* aff. *premolica, Protancyloceras* sp.
	Bivalvia	*Clamys* sp., *Lucina* sp. "*Macrocallista*" *antarctica, Malletia* sp., *Nucula* (*Leionucula*) sp., *Nuculana livingstonensis*
	Gastropoda	"*Phasianella*" sp.
	Scaphopoda	*Dentalium* sp.
	Annelida	Serpulidae indet.
	Brachiopoda	Terebratulida indet.

Table V. Ecological guilds recognized in the Gustav Group.

GUSTAV GROUP		
GEOLOGICAL UNITS	**GUILDS**	**TAXA**
PEDERSEN FORMATION	Carnivorous nectonic	Cephalopoda (*Favrella wilckensi*)
KOTICK POINT FORMATION	Suspensivorous sessile epifaunal	Bivalvia *Aucellina* cf. *andina, Maccoyella* sp.) Brachiopoda (*Lamellaerynchia* sp.) Annelida (*Rotularia calosa*)

Continue

GUSTAV GROUP		
GEOLOGICAL UNITS	**GUILDS**	**TAXA**
KOTICK POINT FORMATION	Facultatively mobile epifaunal suspensivorous	Bivalvia (*Anopaea* sp., *Inoceramus* cf. *sutherlandi, Inoceramus stoneleyi*
	Shallow infaunal detritivorous	Gastropoda (Aporrhaidae indet.)
	Deep infaunal chemosymbiont	Bivalvia (*Sphaera striata*)
	Carnivorous nectonic	Cephalopoda (*Acanthohoplites* sp., *Anagaudryceras sacya, Belemnopsis* sp., *Beudanticeras* sp., *Kossmaticeras meseticum* (=*Bonarelliceras meseticum*), *Cymatoceras* cf. *virgatum, Dimitobelus* cf. *stimulus* var. *extremis, Dimitobelus* cf. *superstes, Dimitobelus* (*Dimitobelus*) *stimulus, Dimitobelus praelindsayi, "Lithancylus"* cf. *guanacoense, Lytoceras* sp., *Peltocrioceras* sp., *Phyllopachyceras* sp., *"Pseudothurmannia"* cf. *mortilleti, Ptychoceras* sp., *Sanmartinoceras* sp., *Silesites* aff. *antarcticus, Silesites desmoceratoides, Dimitobelus* (*Tetrabelus*) *seclusus, Dimitobelus* (*Tetrabelus*) sp., *Tetragonites heterosulcatus, Lytoceras timotheanus* (= *Tetragonites timotheanus*), cf. *"Wellmanites" zelandicus*)
WHISKY BAY FORMATION	Suspensivorous sessile epifaunal	Bivalvia (*Aucellina* cf. *hughendenensis, Eriphyla* sp., *Tethynoceramus madagascariensis*) Brachiopoda (*Cretirhynchia* sp., *Kingena* sp., *Ptilorhynchia australis, Recthyris whiskyi, Terebratella* sp., *Terebratula* sp.) Porifera (*Laocoetis piserai*)
	Facultatively mobile epifaunal suspensivorous	Bivalvia (*Anopaea* sp., *Birostrina concêntrica, Entolium* sp., *Inoceramus* (*Actinoceramus*) *concentricus, Inoceramus carsoni, Inoceramus pictus, Inoceramus stonelyi*)
	Carnivorous nectonic	Cephalopoda *(Anagaudryceras sacya, Calycoceras* sp., *Desmoceras* aff. *latidorsatum, Desmoceras* sp., *Dimitobelus* cf. *dayi, Dimitobelus* (*Dimitobelus*) cf. *superstes, Dimitobelus* (*Dimitobelus*) *stimulus, Dimitobelus diptycha, Dimitobelus* (*Tetrabelus*) sp., *Gaudryceras* cf. *stefaninii, Gaudryceras* (*Gaudryceras*) *strictum, Gaudryceras* sp., *Helicancylus patagonicum, Hysteroceras* aff. *orbignyi, Kossmaticeras* (*Kossmaticeras*) aff. *sakondryense, Kossmaticeras* sp., ?*Labeceras* sp., *Lechites* sp., *Mariella* sp., ?*Marshallites* sp., *"Newboldiceras"* sp., ?*Pachydesmoceras* sp., *"Parahibolites" blanfordi, Phyllopachyceras* sp., *Pseudouhligella* sp., *Pseudoxybeloceras* sp., *Ptychoceras* sp., *Sciponoceras* sp., *Silesites* aff. *antarcticus, Dimitobelus* (*Tetrabelus*) *seclusus, Dimitobelus* (*Tetrabelus*) *whitehousei*)
	Carnivorous epifaunal	Gastropoda (Pleurotomariidae)
	Carnivorous semi-infaunal	Gastropoda (Naticidae)
	Facultatively mobile infaunal suspensivorous	Bivalvia (*Eriphyla* sp.)
HIDDEN LAKE FORMATION	Facultatively mobile epifaunal suspensivorous	Bivalvia (*Inoceramus africanus* (= *Mytiloides africanus*), *Inoceramus australis, Inoceramus neocaledonicus*)

Continue

Conclusion

GUSTAV GROUP		
GEOLOGICAL UNITS	**GUILDS**	**TAXA**
HIDDEN LAKE FORMATION	Carnivorous nectonic	Cephalopoda (*Baculites cazadorianus, Baculites* sp., *Dimitobelus* cf. *ongleyi, Eubostrychoceras* sp., *Eupachydiscus macoveii, Eupachydiscus* sp., *Gaudryceras* (*Gaudryceras*) *strictum, Gaudryceras* sp., *Menuites* (*Neopachydiscus*) *hauthalli, Menuites* (*Neopachydiscus*) sp., *Menuites* (*Neopachydiscus*) *steinmanni, Menuites patagonicus, Peroniceras* sp., *Pseudoxybeloceras* sp., *Lytoceras epigonus* (= *Tetragonites epigonus*))
	Detritivorous semi-infaunal	Echinodermata (*Giraliaster* sp.)
UNKNOWN FORMATION	Suspensivorous sessile epifaunal	Bivalvia (*Aucellina andina-radiaostriata*) Annelida (*Rotularia calosa*)
	Facultatively mobile epifaunal suspensivorous	Bivalvia (*Inoceramus neocomiensis*)
	Shallow infaunal detritivorous	Gastropoda (*Aporrhaidae* indet.)

Table VI. Ecological guilds recognized in the Marambio Group.

MARAMBIO GROUP		
GEOLOGICAL UNITS	**GUILDS**	**TAXA**
SANTA MARTA FORMATION	Suspensivorous sessile epifaunal	Brachiopoda (*Capillithyris* sp., *Magas* cf. *mesembrina* (= *Kingena* cf. *mesembrina*)) Annelida (*Rotularia* sp.)
	Facultatively mobile epifaunal suspensivorous	Bivalvia (*Inoceramus australis, Inoceramus neocaledonicus, Lima* sp., *Limatula* sp.)
	Carnivorous sessile epifaunal	Anthozoa (Caryophylliidae indet.)
	Suspensivorous mobile epifaunal	Bivalvia (*Entolium* sp.)
	Herbivorous mobile epifaunal	Gastropoda (*Cerithium* sp.)
	Carnivorous mobile epifaunal	Gastropoda ("*Nerinea*" sp., *Taioma* sp., *Cinulia* sp., *Scaphander* sp., *Terebra* sp.)
	Omnivorous mobile epifaunal	Gastropoda (*Pleurotomaria* sp.)
	Suspensivorous sessile semi-infaunal	Bivalvia (*Pinna* sp., *Modiolus* sp.)
	Suspensivorous mobile semi-infauna	Gastropoda (*Turritella* sp.)
	Semi-infaunal slow-moving detritivore	Gastropoda (*Aporrhais* sp.) Scaphopoda (Dentallidae indet.) Echinodermata (*Nordenskjoeldaster australis*)
	Carnivorous mobile semi-infaunal	Gastropoda (*Eunaticina* sp., *Natica* sp.)
	Facultatively mobile infaunal suspensivorous	Bivalvia (*Austrotrigonia oliveroi, Cucullaea sp., Cyclorisma* sp., *Eriphyla* sp., *Eselaevitrigonia* sp., *Lahillia* sp., *Nipotrigonia* sp., *Oistotrigonia* sp., *Pacitrigonia* sp., *Haumurigonia malagninoi* (=*Pterotrigonia* (*Pterotrigonia*) *malagnoi*), *Haumurigonia spikermanni* (=*Pterotrigonia* (*Rinetrigonia*) *spikermanni*)
	Infaunal sessile/ detritivorous mobile	Bivalvia (*Neilo* sp., *Nucula* sp.) Echinodermata (*Micraster* aff. *Regularis*)
	Deep infaunal sessile/ mobile, suspensivorous	Bivalvia (*Goniomya* sp., *Pholadomya* sp., *Thracia* sp.)
	Deep sessile suspensivorous infaunal	Bivalvia (*Panopea* sp.)
	Suspensivorous sessile infaunal	Bivalvia (*Corbula sp.*)
	Mobile chemosymbiotic infaunal	Bivalvia (*Lucina* sp.)
	Carnivorous nectonic	Cephalopoda ("*Ainoceras zinsmeisteri*", *Anagaudryceras calabozoi*, "*Anapachydiscus constrictus*", "*Anapachydiscus*" sp., *Baculites bailyi, Baculites cazadorianus, Baculites kirki, Baculites rectus, Baculites subanceps*, "*Caledonites validus*", *Damesites* cf. *hetonaiesis, Dimitobelus* cf. *seymourensis, Dimitobelus* (*Dimitobelus*) *ongleyi, Dimitobelus* (*Dimitocamax*) *cramensis, Diplomoceras cylindraceum, Eubostrychoceras* aff. *elongatum, Eubostrychoceras medinai, Eupachydiscus paucituberculatus, Eutrephoceras antarcticum, Nautilus dorbignyanus*

Continue

MARAMBIO GROUP		
GEOLOGICAL UNITS	**GUILDS**	**TAXA**
SANTA MARTA FORMATION	Carnivorous nectonic	(=*Eutrephoceras dorbignyanum*), *Gaudryceras brandyense, Gaudryceras* cf. *strictum, Gaudryceras* (*Gaudryceras*) *strictum, Gaudryceras santamartense, Gaudryceras* sp., *Gaudryceras submurdochi, "Grossouvrites occultus", Hauericeras* sp., *Hoplitoplacenticeras* sp., *Kitchinites angolaensis, Kitchinites* cf. *japonica, Kitchnites* sp., *Kossmaticeras* (*Karapadites*) aff. *centinelaensis, Maorites* sp., *Menuites hauthali, Menuites steinmanni, Metaplacenticeras* cf. *subtillistratum, Kossmaticeras* (*Natalites*) cf. *hauthali, Kossmaticeras* (*Natalites*) cf. *morenoi, Kossmaticeras* (*Natalites*) *rossensis, Kossmaticeras* (*Natalites*) *taylori, Neograhamites* aff. *morenoi, Neograhamites kiliani, Neograhamites taylori, "Neokossmaticeras" redondensis, Neophylloceras* sp., *Parasolenoceras* sp., *Placenticeras* sp., *Polyptychoceras* aff. *obstrictum, Pseudophyllites* sp., *Pseudoxybeloceras lineatum, Pseudoxybeloceras* sp., ?*Pseudophyllites* cf. *latus, "Ryugasella" antarctica, Scalarites* sp., *Scaphites* sp., *Tetragonites* sp., *"Vertebrites"* sp., *Yezoites* sp., *Zelandites pujatoi*)
SNOW HILL FORMATION	Suspensivorous sessile epifaunal	Bivalvia (*Pycnodonte* (*Phygraea*) *vesicularis*) Echinodermata (*Isselicrinus antarcticus*) Anthozoa (?*Astreopora* sp., ?*Parasmilia andersoni* (= ?*Flabellum andersoni*), ?*Pleurocora haueri* (= ?*Oculina nordenskjoeldi*)) Arthropoda (*Euscalpellum antarticum*) Annelida (*Ditrupa varicosa, Rotularia* (*Australorotularia*) *calosa, Rotularia* (*Rotularia*) *dorsolaevis*)
	Facultatively mobile epifaunal suspensivorous	Bivalvia (*Lima* sp., *Limatula* sp., *Entolium seymouriensis, Nordenskjoldia* sp.)
	Microcarnivorous sessile epifaunal	Anthozoa (*Cycloseris deltoidophora* (= *Fungiacyathus deltoidophorus*))
	Herbivorous mobile epifaunal	Gastropoda (*Amberleya* sp.)
	Detritivorous mobile epifaunal	Echinodermata (*Cyathocidaris* sp.) Arthopoda (*Argilloecia* sp., *Bairdia* sp., *Cytherella* sp., *Cytheropteron* sp., *Eocytheropteron carinoalatum, Mandelstamia antarctica, Paguristes* sp., *Paracypris* sp.)
	Carnivorous mobile epifaunal	Gastropoda (*Eudolium mirabilis* (=*Casidaria mirabilis*), *Cinulia* sp., *Scaphander sp., Taioma* sp., *Charonia* sp. (= *Triton* sp.)) Arthropoda (*Hoploparia* sp.)
	Omnivorous mobile epifaunal	Gastropoda (*Pleurotomaria sp.*) Echinodermata (*Cyathocidaris* sp.)
	Suspensivorous sessile semi-infaunal	Bivalvia (*Pinna* sp., *Pinna anderssoni, Modiolus* sp.)
	Suspensivorous mobile semi-infaunal	Gastropoda (*Turritella* sp.)
	Semi-infaunal slow-moving detritivore	Gastropoda (*Aporrhais* sp., *Perissoptera* sp., *Perissoptera nordenskjoldi* (=*Struthiochenopus nordenskjoldi*), Scaphopoda (*Eodentalium grandis, Laevidentalium* sp.) Echinodermata (*Giraliaster lorioli*)
	Carnivorous mobile semi-infaunal	Gastropoda (*Eunaticina* sp., *Natica* sp.)

Continue

MARAMBIO GROUP		
GEOLOGICAL UNITS	**GUILDS**	**TAXA**
	Facultatively mobile infaunal suspensivorous	Bivalvia (*Cucullaea sp., Cyclorisma sp., Eriphyla sp., Eselaevitrigonia regina, Lahillia sp., Oistotrigonia sp., Pacitrigonia sp., Trigonia sp., Conchocele townsendi (=Lucina townsendi and Thyasira townsendi*))
	Sessile/mobile detritivorous infaunal	Bivalvia (*Neilo* sp.) Echinodermata (*Hemiaster* vômer)
	Deep sessile/suspensive mobile infaunal	Bivalvia (Thracia sp., Thracia askinae)
	Suspensivorous sessile infaunal	Bivalvia (*Corbula* sp.)
	Deep sessile suspensivorous infaunal	Bivalvia (*Panopea* sp.,)
	Mobile chemosymbiotic infaunal	Bivalvia (*Lucina* sp., *Solemya* sp.)
	Carnivorous nectonic	Cephalopoda (*Anagaudryceras sanctuarium, Anagaudryceras sp., Anagaudryceras subcompressum, "Anapachydiscus"* sp., *Astreptoceras* sp., *Baculites delvallei, Cymatoceras* sp., *Diplomoceras cylindraceum, Eupachydiscus* sp., *Gaudryceras cf. mite, Gaudryceras rabotense, "Grossouvrites"* sp., *Gunnarites antarcticus, Jacobites anderssoni, Jacobites crofti, ?Jimboiceras antarcticum, Maorites seymourianus, "Natalites"* sp., *Neograhamites cf. kiliani, Neograhamites primus, Phyllopachyceras* sp., *Polyptychoceras* sp., *Pseudophyllites* sp., *Tetragonites* sp.)
LÓPEZ DE BERTODANO FORMATION	Suspensivorous sessile epifaunal	Bivalvia (*Pycnodonte (Phygraea) vesicularis*) Echinodermata (*Isselicrinus antarcticus*) Anthozoa (?*Astreopora* sp., ?*Parasmilia andersoni (= ?Flabellum andersoni), ?Pleurocora haueri (= ?Oculina nordenskjoeldi*)) Arthropoda (*Euscalpellum antarticum*) Annelida (*Ditrupa varicosa, Rotularia (Australorotularia) calosa, Rotularia (Rotularia) dorsolaevis*)
	Facultatively mobile epifaunal suspensivorous	Bivalvia (*Acesta shackletoni, Acesta snowhillensis, Acesta webbi, Entolium sadleri, Entolium seymouriensis, Entolium* sp., *Nordenskjoldia nordenskjoldi, Lima antarctica (= Seymoutula antarctica), Limatula* sp., *Limopsis (Limopsis) antarctica*)
	Microcarnivorous sessile epifaunal	Anthozoa (Bothrophoria ornata, Conocyathus felixi (= Laminocyathus wellsi), Cycloseris deltoidophora (= Fungiacyathus deltoidophorus), Palocyathus seymourensis)
	Detritivorous mobile epifaunal	Arthropoda (*Callianassa meridionalis*) Gastropoda (*Littorina (sensu lato) acktowskiana (= "Vanikoropsis" acktowskiana*))
	Herbivorous mobile epifaunal	Gastropoda (*Tectura (= Acmaea sp.), Amberleya spinigera, Cerithium* sp.)
	Mobile epifaunal, carnivorous	Gastropoda (*Acteon (Tenuiactaeon) antarctihadrum, Austrosphaera bulloide (=Seymourosphaera bulloide e patagônica), Austrosphaera elevata (Seymourosphaera elevata), Austrosphaera patagônica, Colus debrioae, Eudolium mirabilis (= Cassidaria mirabilis), Cryptorhytis phillipiana, Fusinus phillippiana, Fusinus* sp., *Exilia cf. culbertoni (= Graphidula cf. culbertoni*), Heteroterma sp. (= *Heterotrema* sp.), *Leptomaria antipodensis, Leptomaria hickmanae, Leptomaria cf. seymouriensis, Oligoptycha cf. O. concinna, Scaphander* sp., *Seymourosphaera elevata, Taioma charcotianus, Taioma* sp.)
	Omnivorous mobile epifaunal	Gastropoda (*Pleurotomaria larseniana*) Echinodermata (*Cyathocidaris nordenskjoldi, Cyathocidaris patera*)

Continue

MARAMBIO GROUP		
GEOLOGICAL UNITS	**GUILDS**	**TAXA**
	Suspensivorous sessile semi-infaunal	Bivalvia (*Modiolus pontotocensis, Pinna anderssoni, Pinna freneizae, Pinna* sp.)
	Detritivorous mobile semi-infaunal	Gastropoda (*Austroaporrhais larseni, Austroaporrhais stilwelli, Perissoptera nordenskjoldi, Struthiochenopus antarcticus, Struthiochenopus nordenskjoldi, Struthiochenopus hurleyi*) Scaphopoda (*Dentalium* sp, *Laevidentalium wilckensi*)
	Carnivorous mobile semi-infaunal	Gastropoda (*Eunaticina arctowskiana*) Bivalvia (*Euspira* sp.)
	Suspensivorous mobile semi-infaunal	Gastropoda (*Mesalia* sp., *Haustator* sp.)
	Sessile/mobile detritivorous infaunal	Bivalvia (*Jupiteria sp., Neilo gracilis (=Malletia gracilis* and *Australoneilo gracillis),Neilo casei*)
	Facultatively mobile infaunal suspensivorous	Bivalvia (*Cucullaea antartica, Cucullaea ellioti, "Cyclorisma chaneyi", Cyclorisma* sp.,*Cyclorismina/Marwickia* sp., *"Dozyia dryqalskiana", Eriphyla* sp., *Eselaevitrigonia regina, Cyprina larseni (= Lahillia larseni), "Lahillia* sp.", *Linotrigonia pygoscelium, Leionucula suboblonga (= Nucula (Leionucula) suboblonga, Oistotrigonia pygoscelium*)
	Deep sessile/ suspensivorous mobile infaunal	Bivalvia (*Goniomya hyriformis, Pholadomya gracilis, Thracia* sp., *Thracia askinae*)
	Deep sessile suspensivorous infaunal	Bivalvia (*Panopea clausa*)
	Chemosymbiotic sessile/mobile infaunal	Bivalvia (*Lucina scotti, Solemya rossiana, Saxolucina* sp., *Parathyasira austrosulca*)
	Carnivorous nectonic	Cephalopoda (*Anagaudryceras seymouriense (= Graudryceras seymouriense), Diplomoceras cylindraceum (= Diplomoceras lambi), Nautilus dorbgnyanum, (= Eutrephoceras dorbignyanum), Kossmaticeras gemmatus (= Grossouvrites gemmatus), Kossmaticeras johare (Grossouvrites joharae), Gunnarites antarcticus, Gunnarites bhavaniformis, Jacobites crofti, Kitchinites darwini, Kitchinites laurae, Maorites densicostatus, Maorites seymourianus, ?Maorites sp., Maorites tuberculatus, Maorites weddelliensis, Pachydiscus ootacodensis, Pachydiscus (Pachydiscus) ultimus, Pachydiscus riccardii, Pseudophyllites loryi, Anagaudryceras varuna (= Zealandites varuna*))
UNKNOWN FORMATION	Suspensivorous sessile epifaunal	Bivalvia (*Phelopteria* sp.) Annelida (*Serpula* sp) Brachiopoda (*Protegulorhynchia meridionalis, Rossithyris humpensis, Terebratella* sp., *Terebratula* sp., *Terebratulina* sp.)
	Carnivorous mobile epifaunal	Gastropoda (*Taioma globus*)
	Omnivorous sessile semi-infaunal	Gastropoda *(Lagena antártica)*
	Facultatively mobile infaunal suspensivorous	Bivalvia (*Cucullaea grahamensis, Cytherea antarctica, Lahiilia (Lahiilia) luisa*)
	Deep sessile/suspensive mobile infaunal	Bivalvia (*Pholadomya gracillis, Homomya rinaldii*)

Continue

Conclusion

MARAMBIO GROUP		
GEOLOGICAL UNITS	**GUILDS**	**TAXA**
	Carnivorous nectonic	Cephalopoda (*Gaudryceras cf. crassicostatum, Gaudryceras proemite, Gunnarites flexuosus, Gunnarites gunnari, Gunnarites kalika, Gunnarites pachys, Gunnarites paucinodatus, Gunnarites rotundus, Hoploscaphites quiriquinensis, Neophylloceras hetonainse, Neophylloceras, meridianum, Parapuzosia* sp., *Patagiosites aff. amarus, Phyllopachyceras forbesianum, Phylloptychoceras zelandicum, Pseudophyllites peregrinus, Saghalinites cala*)

Table VII. Ecological guilds recognized in the Fossil Bluff Group.

FOSSIL BLUF GROUP		
GEOLOGICAL UNITS	**GUILDS**	**TAXA**
HIMALAIA RIDGE FORMATION	Facultatively mobile epifaunal suspensivorous	Bivalvia (*Grammatodon* sp., *Inoceramus* sp., *Anopaea callistoensis*)
	Suspensivorous sessile semi-infaunal	Bivalvia (*Pinna* sp.)
	Infaunal mobile, suspensivorous	Bivalvia (*Myophorella* sp.)
	Deep sessile/suspensivorous mobile infaunal	Bivalvia (*Pholadomya* sp.)
	Carnivorous nectonic	Cephalopoda (*Haplophylloceras* sp., *Raimondiceras* sp.)
SPARTAN GLACIER FORMATION	Epifaunal sessile/slow-moving, suspensivorous	Bivalvia (*Anopaea* sp., *Inoceramus deltoides, Inoceramus* sp., *Parainoceramus* sp.)
	Facultatively mobile epifaunal suspensivorous	Bivalvia (*Aucellina caucasia-aptiensis, Aucellina radiatrostriata, Aucellina* sp.)
	Carnivorous nectonic	Cephalopoda (*Belemnopsis alexandri, Belemnopsis gladiatoris,* cf. *Belemnopsis madagascariensis, Bochianites* sp., *Olcostephanus* sp., *Sanmartinoceras* sp.
PLUTO GLACIER FORMATION	Facultatively mobile epifaunal suspensivorous	Bivalvia (*Arcinella* sp.) Brachiopoda (*Penzhinothyris imbricata*) Arthropoda (*Pycnolepas articulata*)
	Epifaunal slow-moving carnivore/detritivore	Echinodermata (*Mesophiomusium paragraysonensis*)
	Slow-moving epifaunal, carnivorous	Echinodermata (*Ophiacantha* sp.)
	Epifaunal slow-moving detritivorous	Echinodermata (*Hemipedina taylori*)
	Slow-moving epifaunal, scraper	Echinodermata (*Notidisaster subitus, Australidiadema alexandri*)
	Facultatively mobile epifaunal suspensivorous	Bivalvia (*Entolium* sp., *Inoceramus* sp.)
	Suspensivorous sessile semi-infaunal	Bivalvia (*Pinna* sp.)
	Sessile/mobile carnivorous infaunal	Bivalvia (*Cuspidaria* sp.)
	Deep sessile/mobile infaunal suspensivorous	Bivalvia (*Thracia* sp.)

Continue

FOSSIL BLUF GROUP		
GEOLOGICAL UNITS	**GUILDS**	**TAXA**
	Carnivorous nectonic	Cephalopoda (*Aconeceras* sp., *Antarcticoceras* sp., *Dimitobelus* sp., *Emericiceras* sp., *Eulytoceras* sp., *Helicancylus patagonicus, Hypophylloceras* sp., *Lithancylus* sp., *Lytoceras* sp., *Neosilesites* sp., *Peratobelus oxys, Phylloceras* sp., *Phyllopachyceras* sp., *Sanmartinoceras* sp., *Dimitobelus (Tetrabelus) willyi, Tropaeum* sp)
NEPTUNE GLACIER FORMATION	Epifaunal sessile, suspensivorous	Bivalvia (*Aucellina* sp.)
	Mobile epifaunal scraper	Gastropoda *(Vanikoropsis* sp.)
	Epifaunal slow-moving detritivorous	Echinodermata (*Hemipedina taylori*)
	Facultatively mobile epifaunal suspensivorous	Bivalvia (*Inoceramus* sp.)
	Shallow mobile detritivorous infaunal	Echinodermata (*Hemiaster* cf. *zululandensis*)
	Suspensive mobile shallow infaunal	
	Facultatively mobile infaunal suspensivorous	Bivalvia (*Eslaevitrigonia* sp., *Nototrigonia* sp., *Pacitrigonia* sp., *Pterotrigonia* sp.)
	Deep infaunal sessile, suspensivorous	Bivalvia (*Panopea* sp.)
	Carnivorous nectonic	Cephalopoda (*Aconeceras* sp., "*Antarcticoceras*" sp., *Dimitobelus* sp., "*Eulytoceras*" sp., *Lytoceras* sp., *Phyllopachyceras* sp., *Dimitobelus* (*Tetrabelus*) sp.)
UNKNOWN FORMATION	Suspensivorous sessile epifaunal	Bivalvia (*Aucellina andina-radiatostriata, Buchia* sp., *Praeaucellina*) Annelida (*Rotularia australis*) Brachiopoda (*Acanthorynchia* sp., *Discina* sp., *Lamellarhynchia* sp., *Prochlidonophora* sp., *Ptilorynchia* sp., *Terebratula lamelosa*) Echinodermata (*Isocrinus* sp.) Arthropoda (*Brachyzapfes* sp., *Cretiscalpellum* sp.)
	Mobile epifaunal scraper	Gastropoda (*Amphitrochus* sp., *Procerithium* sp., *Rissoina* sp.)
	Carnivorous mobile epifaunal	Gastropoda (*Proscala* sp., *Turriscala* sp.) Arthropoda (*Enoploclytia* sp., *Glyphea* sp., *Mecochirus* sp., *Palaeastacus* sp., *Protocallinassa* sp., *Sclueteria* sp., *Trachysoma* sp.)
	Facultatively mobile epifaunal suspensivorous	Bivalvia (*Anopaea* cf. *mandíbula, Anopaea trapezoidalis, Grammatodon (Indogrammatodon*) cf. *robusta, Grammatodon (Nanonavis) falcatus, Grammatodon (Nanonavis) alexandra, Grammatodon (Indogrammatodon*) aff. *fyfei, Grammatodon subrectangulus, Grammatodon (Indogrammatodon) antarctica, Inoceramus anglicus, Inoceramus neocomiensis, Inoceramus ovatus, Pecten* cf. *argentinus*)

Continue

Conclusion

FOSSIL BLUF GROUP		
GEOLOGICAL UNITS	**GUILDS**	**TAXA**
	Shallow infaunal mobile, detritivorous	Echinodermata (*Epiaster* sp.)
	Shallow sessile/suspensivorous mobile infaunal	Bivalvia (*Cyprina* sp., *Myophorella Alexandra*)
	Mobile semi-infaunal, detritivorous	Gastropoda (*Anchura* sp., *Aporrhais* (*Tessarolax*) *antarctica*) Echinodermata (*Anorthopygus* sp.)
	Semi-infaunal sessile, suspensivorous	Bivalvia (*Pinna kotsinensis, Pinna antarctica, Pinna* cf. *robinaldina*)
	Semi-infaunal sessile/suspensive mobile	Gastropoda (*Turritella* sp.)
	Deep infaunal sessile/slow-moving chemosymbiont	Bivalvia (*Sphaera striata*)
	Carnivorous nectonic	Cephalopoda (*Aconeceras* aff. *nisoides, Acrioceras* aff. *voyanum, Acrioceras* sp., *Ancyloceras patagonicum, Ancyloceras* sp., *Antarcticoceras antarcticum, Bochianites gracilis, Belemnopsis gladiatoris, Belemnopsis alexandri, Belemnopsis* aff. *uhligi, Callizoniceras* sp., *Costidiscus* sp., *Emericiceras* sp., *Eotetratgonites, Eotetragonites* sp., *Eulytoceras* aff. *polare, Hamites* sp., *Himalayites* sp., *Hypophylloceras, Hibolites antarctica, Hibolites subfusiformis, Hibolites* cf. *compressus, Hibolites* aff. *marwicki mangaoraensis, Lechites* sp., *Lithancylus* sp., *Lytoceras* sp., *Macroscaphites* sp., *Neocosmoceras* aff. *sayni, Neocosmoceras* sp., *Neohibolites* cf. *miyakoensis, Neohibolites minimus* cf. var. *submedius, Neohibolites minimus* cf. var. *oblongus, Phylloceras* sp., *Phyllopachyceras aureliae, Phyllopachyceras* cf. *baborense, Pseudothurmannia* sp., *Pseuthurmannia* cf. *mortilleti, Ptychoceras* sp., *Sanmartinoceras patagonicum, Sanmartinoceras (Theganeceras) grande, Sarasinella* aff. *hondana, Sarasinella* sp., *Silesites* aff. *vulpes, Silesites antarcticus, ?Silesites desmoceratoides, Silesites* sp., *Spiticeras* sp., *?Substreblites, Substreblites* sp., *Toxoceratoides* sp.)
	Omnivorous nectonic	Cephalopoda (*Hemihoplites* sp.)

Table VIII. Ecological guilds recognized in the Byers Group.

BYERS GROUP		
GEOLOGICAL UNITS	**GUILDS**	**TAXA**
PRESIDENT BEACHES FORMATION	Carnivorous nectonic	Cephalopoda (*Antarctiteuthis donovani, Perisphinctes loncochesis* (= *Argentiniceras lonchochense*), *Blanfordiceras* sp., *Bochianites* sp., *Himalyites* sp., *Spiticeras bilobatum, Spiticeras* (*Spiticeras*) *spitiensis, Ammonites tripartium* (= *Spiticeras tripartium*)
	Suspensivorous sessile epifaunal	Bivalvia (*Manticula complanata, Praeaucellina umbonoradiata*)
	Facultatively mobile epifaunal suspensivorous	Bivalvia (*Anopaea* sp. nov.?, *Inoceramus* sp.)
CHESTER CONE FORMATION	Suspensivorous sessile epifaunal	Bivalvia (*Praeaucellina*" *umbonoradiata*)
	Carnivorous nectonic	Cephalopoda (*Belemnopsis* (*Belemnopsis*) *alexandri, Belemnopsis* (*Belemnopsis*) *gladiatoris, Bochianites* sp., *Neocomites* sp.,?*Olcostephanus* cf. *atherstoni, Uhligites* sp.)
UNKNOWN FORMATION	Suspensivorous sessile epifaunal	Annelida (Serpulidae indet.) Brachiopoda (Terebratulida indet.)
	Facultatively mobile epifaunal suspensivorous	Bivalvia (*Clamys* sp.)
	Herbivorous mobile epifaunal	*Phasianella* sp.
	Detritivorous mobile semi-infaunal	*Dentalium* sp.
	Facultatively mobile infaunal suspensivorous	Bivalvia (*Macrocallista antarctica*)
	Sessile/mobile detritivorous infaunal	Bivalvia (*Nucula* (*Leionucula*))
	Detritivorous mobile infaunal	Bivalvia (*Malletia* sp.)
	Infaunal sessile/mobile chemosymbiont	Bivalvia (*Lucina* sp.)
	Carnivorous nectonic	Cephalopoda (*Berriasella* sp., *Bochianites* aff. *gerardi, Bochianites* aff. *glaber, Haplophylloceras strigile, Neocomites neocomiensis* aff. *premolica, Protancyloceras* sp.)

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