SHORT NOTES

AN UNIDENTIFIED NEMATODE-TRAPPING FUNGUS FROM A POND ON ALEXANDER ISLAND

By N. R. MASLEN*

ABSTRACT. The occurrence of a nematophagous constricting ring fungus is reported for the first time from the continental Antarctic zone; it also represents the most southerly record for a predacious fungus. Although unidentified, the fungus with its nematode prey was isolated from algal and moss material growing in a fresh-water pool near Ablation Point, Alexander Island.

NEMATOPHAGOUS hyphomycetes are known to prey mainly, though not exclusively, on nematodes (Duddington, 1951; Soprunov, 1958; Duddington and Wyborn, 1972; and others). They are of interest to mycologists and plant nematologists because of their potential as biological control agents. Webster (1972) reviewed fungal parasites and predators of nematodes in this context and briefly described the main types of predacious fungi. However, much more information is required regarding the occurrence, distribution, abundance and ecology of predacious fungi and their prey in order to facilitate selection of potential taxa for biological control. While there is every indication that predacious fungi are at least as cosmopolitan as the free-living nematodes, this is not fully supported by the literature.

Nematodes have been widely reported from both the Northern and Southern Hemispheres. Most records of predacious fungi are from the Northern Hemisphere, largely from North America and Europe (Soprunov, 1958; Ruokola and Salonen, 1967; Dowe, 1972). Fowler (1970) has isolated several species in New Zealand. The northernmost nematode records are from Ellesmere Island (lat. 81°49′N, long. 71°18′W) in the Canadian high Arctic; the southernmost, from the Ross Sea area (Ross Island, Victoria Land; lat. 77°31′S, long. 162°17′E) in the continental Antarctic zone (see Holdgate, 1970, p. 730). The most northerly reports of predacious fungi are those of Ruokola and Salonen (1967) and Salonen and Ruokola (1968) from Finnish saunas, between lat. 60°50′ and 63°20′N. Until now, the southernmost record was that of an unidentified three-ringed constricting ring fungus isolated from liverwort and lichen vegetation on the Terra Firma Islands, Marguerite Bay (lat. 68°42′S, long. 67°33′W) at the southern extremity of the maritime Antarctic zone (Duddington and others, 1973). These authors also reported a similar predacious fungus from moss and soil from Elephant Island, South Shetland Islands (lat. 61°10′S, long. 55°14′W) and Coronation and Signy Islands, South Orkney Islands (lat. 60°42′S, long. 45°38′W), while four other species were also described from Signy Island. Gray (1975) reported 12 positively identified species and a further three unidentified species of nematophagous fungi from a wide range of moss and soil samples from Signy Island.

In the austral summer of 1973–74, samples of algae (predominantly species of *Phormidium* and *Calothrix*) and moss (predominantly *Campylium polygamum* and *Dicranella* sp.) were collected by R. B. Heywood (British Antarctic Survey) from a depth of 0.5–6.0 m in some fresh-water ponds in the vicinity of Ablation Point, Alexander Island (lat. 70°49′S, long. 68°25′W) in the coastal continental Antarctic zone (Holdgate, 1970). Some of the samples were examined by the author for determination of nematode taxa.

Details of the topography, geology, climate, hydrology and limnology of the area have been given by Heywood (1977). The Ablation Point area comprises 700 km^2 of largely snow- and ice-free terrain adjacent to the ice shelf of George VI Sound and about 100 km from the open sea. The fresh-water bodies range up to 10 000 m^2 and up to 6 m in depth; they are ice-free

* Present address: Centre for Overseas Pest Research, College House, Wrights Lane, London W8 5SJ.

between November and early February but for much of the remaining period all but the deepest pools must freeze solid. Some larger deeper lakes are permanently frozen at their surface. The climate of the area is cold (with a mean summer air temperature of just below 0° C and a mean annual temperature of about −9° C) and arid (less than 20 cm water equivalent per year), but not as extreme as continental inland ice-free areas. Temperatures as high as 15° C were recorded in the shallower pools and 7.5° C in the deeper ones (Heywood, 1977).

Three undescribed species of free-living nematode (all species of *Mesodorylaimus*) were found, together with *Plectus parietinus* and *Eudorylaimus antarcticus*, both previously recorded from the Antarctic Peninsula (Spaull, 1973). A specimen of *Mesodorylaimus* sp. B (see Heywood, 1977) showed a fungal constricting ring around the anterior end. The constricting nature of this ring and what is probably an infection hypha, together with numerous trophic hyphae emanating from the ring, are shown in Fig. 1. Identification was impossible because of absence of conidia (personal communication from C. H. E. Wyborn). No further hyphomycetes were found but this is the first predacious fungus to be recorded from the continental Antarctic zone, and thereby, the most southerly record to date. It is also the first Antarctic record of such a fungus from an aquatic environment.

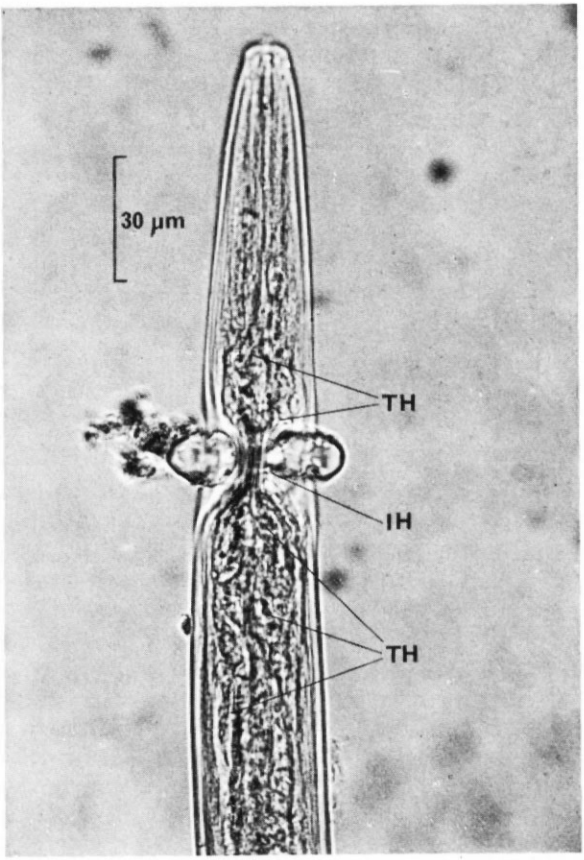

Fig. 1. Constricting ring of nematophagous fungus around the anterior end of *Mesodorylaimus* sp. B. IH Infection hypha; TH Trophic hyphae.

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THE FIRST RECORD OF A FUR SEAL BIRTH ON SIGNY ISLAND, SOUTH ORKNEY ISLANDS

By S. P. J. KIGHTLEY *and* J. R. CALDWELL

ABSTRACT. The first breeding record of Antarctic fur seal on Signy Island, South Orkney Islands, was reported in 1977, and details of the event and status of the local population are given.

ON 8 February 1977 a recently born fur seal pup (*Arctocephalus gazella*) (Fig. 1) was found on Signy Island, South Orkney Islands. This was the first recorded pupping on the island since the discovery of the South Orkney Islands by Powell in 1821.

The southern fur seal was almost exterminated by sealing during the nineteenth and early twentieth centuries, eventually gaining the status of a protected species (Marr, 1935; Bonner and Laws, 1964). Laws (1973) recorded the first fur seal to visit Signy Island "in recent years" in 1948 and he also documented the discovery of breeding colonies on Coronation Island (Meier Point), Monroe Island, Powell Island, the Gosling Islands and Michelsen Island. Marr (1935) considered that Signy Island had the best beaches for haul-out in the group, but that the South Orkney Islands as a whole enjoyed too short an ice-free summer to allow successful

Fig. 1. The fur seal pup 10 days after discovery.

breeding. Caldwell and Kightley (1977) compiled information from unpublished reports and carried out a census to show the current trend of increase in the numbers of seals visiting Signy Island in the post-breeding summer period. The census, at the end of February 1977, recorded 2 018 fur seals. Seven seals tagged as pups at Bird Island, South Georgia, were found during the season. This proportion of tagged to untagged animals is similar to that recorded for emigration from Bird Island to newly colonized South Georgian mainland beaches (personal communication from M. R. Payne) and suggests that the increase in fur seal numbers in the South Orkney, South Shetland and South Sandwich Islands can be attributed to emigration from Bird Island.

The most interesting feature of the pup's birth was its late date. The fur seals at Bird Island pup over a short well-defined period in December (Bonner, 1968; Payne, 1977). At Signy Island, the group of cow, pup and attendant bull (Fig. 2) was found just above the high-water mark on a flat protected beach to the north of Cemetery Bay, with about 150 other fur seals within 50 m. Black woolly fur, weak poorly co-ordinated movements, and 5 cm of umbilical cord attached, led us to estimate the pup's age as no more than 2 or 3 days. Frequent visits were made to observe the group and on 10 February 1977 the female was absent, and the bull was actively guarding the pup. Both of these points are of interest, since cows do not usually leave their pups to go on feeding trips until 8 days after birth, and bulls generally show no protective responses towards pups. The bull in this case made every attempt to come between photographers and the pup, and under continued harrassment would use its head gently to drive the pup away to a safer place. The bull itself was young, being smaller than many others we had seen, and without the fighting scars borne by most breeding bulls. On 24 February, both adults were absent and the pup was playing with pebbles, still within a few metres of where it had first been found. After a storm on 9–10 March, the pup was found in the water for the first time, playing with a piece of seaweed. On 14 March the bull and the pup were found

Fig. 2. The fur seal cow, pup and bull 7 days after discovery.

at a new site about 40 m inland. On 25 March the pup was in the last stage of moult, with a few of the long black hairs remaining on the top of the head only. Even at this time, the bull appeared to be distressed and tried to protect the pup when it was approached. The pup was last seen on 27 April, in good health.

Copulation between the bull and the cow, both of which were very wary whenever humans were about, was not observed. The cow was seen to act submissively towards the bull when they were together, so there is every reason to suppose that copulation will have occurred. As cows are usually faithful to their breeding beaches, her return in the 1977–78 season may be anticipated. Given the freak timing of this solitary birth, there are, however, no real grounds for predicting the development of a stable breeding group on Signy Island.

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FEEDING BIOLOGY OF FREE-LIVING ACARI AT SIGNY ISLAND, SOUTH ORKNEY ISLANDS

By D. G. GODDARD

ABSTRACT. Qualitative observations are reported on the feeding habits of nine species of free-living Acari at Signy Island, South Orkney Islands. *Gamasellus racovitzai* (Trouessart) (Mesostigmata), the only predator, fed exclusively on other Acari and Collembola. *Alaskozetes antarcticus* (Michael) and *Halozetes belgicae* (Michael) (Cryptostigmata) fed on organic detritus, lichens and algae, while *Neohyadesia signyi* Hughes and Goodman (Astigmata) fed on fresh-water algae. The remaining species belonged to the Prostigmata; *Eupodes minutus* (Strandtmann) and *Ereynetes macquariensis* Fain fed on algae and fungal hyphae; *Stereotydeus villosus* (Trouessart) and *Nanorchestes antarcticus* Strandtmann fed on algae, while *Tydeus tilbrooki* Strandtmann consumed algae, fungal hyphae and lichen apothecia.

THE extensive literature on the feeding of free-living soil mites, reviewed by Wallwork (1970) and Harding and Stuttard (1974), has mainly concerned species of Cryptostigmata with only limited information on the soil-dwelling Prostigmata (Karg, 1963; Gerson, 1972) and Mesostigmata (Bhattarcharyya, 1962; Luxton, 1966; Wallwork, 1967). The feeding biology of Antarctic terrestrial Acari is largely unknown with only brief notes provided by Strong (1967), Fitzsimons (1971) and Gless (1972).

The observations reported here were made in 1971–74 during an ecological study of the free-living terrestrial mites occurring in two contrasting moss communities, the Signy Island terrestrial reference sites (SIRS). The sites have been described by Tilbrook (1973) and Goddard (1977*a*, *b*, 1979, 1980,) has provided information on the Acari. These brief notes are qualitative but provide some base-line information, especially in view of the sparse data on feeding in terrestrial Prostigmata and Mesostigmata.

Observations were made on living Acari both in the field and in laboratory cultures, and in addition squash-slide preparations were made of individual mites in an attempt to identify gut contents. The following annotated list summarizes the observations made on the feeding biology of the species studied.

MESOSTIGMATA

Gamasellus racovitzai (Trouessart)

All life stages of this species were observed feeding both in the laboratory and in the field. *G. racovitzai* is entirely predatory in habit and has typical styliform mouthparts for piercing and sucking, characteristic of the predatory Mesostigmata. It was observed to capture and feed on various species of Prostigmata: *Stereotydeus villosus* (Trouessart), *Eupodes minutus* (Strandtmann), *Ereynetes macquariensis* Fain and *Tydeus tilbrooki* Strandtmann; and on the collembolan *Cryptopygus antarcticus* Willem. All life stages of *G. racovitzai* were able to capture and overpower prey larger than themselves. However, prey of a disproportionate size was not usually tackled (large collemboles were not suitable for the larvae and protonymphs nor were small prostigmatids for the adults and deutonymphs). The heavily sclerotized Cryptostigmata were rarely utilized as prey, their cuticle being resistant to stylet penetration. The mechanism of prey capture has been described by Strong (1967). The ingested food of *G. racovitzai* appeared to be entirely fluid in nature as did the faecal material produced. In culture, *G. racovitzai* was unusually cannibalistic even in the presence of abundant alternative prey. In the field, prey location appeared to be the result of chance encounter during a seemingly random wandering behaviour. Captured prey was often carried impaled on the stylets for several hours, presumably while secreted digestive enzymes acted on the prey tissues and fluids.

CRYPTOSTIGMATA

Alaskozetes antarcticus (Michael)

This species has chelate-dentate mouthparts and was observed grazing on the following species of crustose lichens: *Rinodina petermanni* (Hue) Darb., *Acarospora macrocyclos* (Vain.), *Caloplaca regalis* (Vain.) Zahlbr. and *Verrucaria elaeoplaca* (Vain.). The entire thallus of each species was gradually consumed. Other materials ingested included organic debris from the vicinity of bird and seal corpses, the guano-rich soils in and around sea-bird colonies and the foliose alga *Prasiola crispa* (Lightf.) Menegh. In the field the preferred food of this mite appeared to be well-decayed organic detritus.

Halozetes belgicae (Michael)

This mite was observed to feed on food materials similar to those of *A. antarcticus* but it was more often found grazing live lichens than feeding on organic debris. Two additional lichens noted as being grazed by *H. belgicae* but not by *A. antarcticus* were *Buellia latemarginata* Darb. and *Bacidia stipata* M. Lamb.

As both the cryptostigmatid species are common, large and robust, and ingest solid food with the production of solid faecal material, they would be the most suitable Acari at Signy Island for detailed studies of their assimilation and growth rates.

ASTIGMATA

Neohyadesia signyi Hughes and Goodman

This fresh-water mite occurs amongst organic detritus in shallow (0–200 mm) brackish pools and is known only from Signy Island. The pale translucent bodies of these mites frequently contained up to four compact dark green food balls composed of masses of algal filaments (*Lyngbia* sp.), unicells and diatoms. These boluses disappeared over 20–30 days starvation in distilled water. The diatoms alone remained intact after 30 days and were presumed indigestible. This species may also lend itself to quantitative feeding studies.

PROSTIGMATA

All of the Prostigmata on Signy Island have styliform mouthparts and are small, fragile and difficult to culture, and most species are difficult to collect alive in large numbers. Thus the prostigmatid mites are not easy subjects for study in terms of feeding biology.

Eupodes minutus (Strandtmann) and *Ereynetes macquariensis* Fain

Specimens of these two species in squash preparations were full of oil-like droplets and amorphous green matter. No identifiable cell fragments were seen but several specimens contained fragments of fungal hyphae. The green pigment was not present in starved animals and was assumed to be chlorophyll derived from algal cells. These mites occurred in large numbers amongst moss shoots, especially the drier turf and cushion-forming varieties (*Polytrichum alpestre* Hoppe, *P. alpinum* Hedw., *Chorisodontium aciphyllum* (Hook. f. et Wils.), *Grimmia antarctici* Card. and *Andreaea* spp.) but no evidence was found of their feeding directly on moss cells. It is thought that the main foods of these mites are the numerous epiphytic algae on moss shoots.

Stereotydeus villosus (Trouessart)

Microscope slide-squash preparations of this species, which is the largest of the Prostigmata on Signy Island, were similar to *E. minutus* and *E. macquariensis* with the guts being full of amorphous green matter which was not present in starved animals. However, a single adult contained many entire green unicellular algae. It is thought that *S. villosus* also feeds on epiphytic algae and appears to be able to ingest whole cells. It is also found in large aggregations under stones and may graze the algae found in these habitats.

Tydeus tilbrooki Strandtmann

T. tilbrooki was the most easily collected and cultured of the small Prostigmata. Gut-squash preparations revealed amorphous green matter which was not present in starved animals. In addition, cell fragments and pieces of fungal hyphae were sometimes observed. In the field, large numbers of *T. tilbrooki* were collected from fruticose and foliose lichens, especially *Xanthoria candelaria* (L.), and from mats of the alga *Prasiola crispa*. In the laboratory, both adults and nymphs of *T. tilbrooki* were observed with their stylets inserted into the fluid mass surrounding *Prasiola crispa* cells, fungal hyphae and the fruiting structures (apothecia) of the lichen *Buellia latemarginata*. Microscopic examination of such fungal hyphae and apothecia after feeding showed them to be ruptured and empty.

Nanorchestes antarcticus Strandtmann

Large numbers of this mite were commonly found under stones on barren ground associated with colonies of a red gelatinous alga (*Chlamydomonas* sp.). Gut-squash preparations of mites from these areas revealed cell fragments and mineral particles in a deep red pigment. In starved animals the pigment was lighter in colour and no cell fragments were seen. In the field, many specimens of *N. antarcticus* were observed clustered around these red algal colonies with their stylets inserted into the gelatinous mass. *N. antarcticus* gut squashes from animals collected from *P. crispa* mats were full of a red-green pigment with cell fragments and occasional entire green unicells. Fitzsimons (1971) also recorded algae in the guts of *N. antarcticus*. No fungal hyphae were observed inside this mite.

Table I summarizes the qualitative feeding information derived from the above observations. Algae were universally acceptable to all the herbivorous species and there is evidence that

TABLE I. FOOD MATERIALS UTILIZED BY SPECIES OF ACARI IN THE FIELD AND IN LABORATORY CULTURE AT SIGNY ISLAND, SOUTH ORKNEY ISLANDS

Species	Type of food material					
	Collembola	*Acari*	*Algae*	*Fungal hyphae*	*Lichens*	*Organic debris*
MESOSTIGMATA						
Gamasellus racovitzai (Trouessart)	+	+				
CRYPTOSTIGMATA						
Alaskozetes antarcticus (Michael)			+	+	+	+
Halozetes belgicae (Michael)			+	+	+	+
ASTIGMATA						
Neohyadesia signyi Hughes and Goodman			+			
PROSTIGMATA						
Eupodes minutus (Strandtmann)			+	+		
Ereynetes macquariensis Fain			+	+		
Stereotydeus villosus (Trouessart)			+			
Nanorchestes antarcticus Strandtmann			+			
Tydeus tilbrooki Strandtmann			+	+	+	

+ Positive observation of feeding.

most species, except perhaps *N. antarcticus*, fed on fungal hyphae. Lichens were grazed by the Cryptostigmata and by a single prostigmatid, *T. tilbrooki*, while consumption of organic debris appears to be restricted to the cryptostigmatids.

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NEW GEOLOGICAL INTERPRETATION OF ADMIRALEN PEAK, KING GEORGE ISLAND, SOUTH SHETLAND ISLANDS

By R. E. S. DAVIES

ABSTRACT. An Upper Cretaceous–Tertiary/Jurassic unconformity, thought to exist at Admiralen Peak, has been re-examined. A uniform alteration regime related to the Crépin Point–Wegger Peak pluton affects all the exposed rock and indicates that the volcanic rocks are all of pre-intrusion age. Only minor disconformities were observed and a Palaeocene age for the volcanic rocks is inferred by analogy with the Marian Cove area of King George Island.

UNCONFORMITIES on Fildes Peninsula and at Admiralen Peak were thought to represent the gap between Jurassic and Upper Cretaceous–Tertiary rocks on King George Island (Barton, 1965). However, Schauer and Fourcade (1964) found no evidence for any Jurassic rocks on Fildes Peninsula and mapped the whole area as Tertiary. Later, Grikurov and others (1970) determined radiometric ages on lavas from Fildes Peninsula and concluded that these were all of Cenozoic age.

Admiralen Peak, an east–west ridge 1 km inland of the north-west end of Admiralty Bay (Figs 1 and 2), was visited in 1959 by G. J. Hobbs who collected rock specimens and plant fossils. Barton (1964, 1965) incorporated these data into accounts of the geology and palaeontology of the island. Barton (1964) described the fossils as *Araucaria* and regarded them as Tertiary in age. The fossiliferous beds were tentatively included in the Ezcurra Inlet Group (Barton, 1965, p. 19), one of four stratigraphical groups he established for Upper Cretaceous–Miocene rocks on King George Island partly on the basis of varied palaeobotanical assemblages. According to Barton (1965, p. 19), this "post-intrusion outlier rests unconformably on the Upper Jurassic rocks (Plate Ic)."

The author could find no field evidence for an angular unconformity at Admiralen Peak, although minor disconformities are common. The exposure consists of a sequence of sub-horizontally bedded lavas and volcaniclastic rocks, the lower part of which (eastern ridge) is dominantly volcaniclastic. Lavas become more common towards the top and a 30 m thick flow constituting the highest member is exposed on the western ridge (Fig. 2). Both gymnospermous wood (personal communication from T. H. Jefferson) and *Araucaria* leaf fragments were found directly below this lava in a tuffaceous sandstone. Conspicuous iron oxide staining of the lower mainly volcaniclastic rocks probably led Barton (1965, p. 12) to postulate a Jurassic age for these rocks by comparison with similar altered rocks of Keller Peninsula. However, the dating of volcanic rocks on King George Island as Jurassic on the basis of their alteration has been shown to be unreliable (Davies, in press).

All the lavas sampled and studied in thin section are essentially similar in their primary petrology and are porphyritic two-pyroxene basaltic andesites. However, they differ in their secondary mineral content and show increasing alteration upwards and towards the north-west. The lowest lava sampled (P.1415.1; Fig. 1) is the freshest but it exhibits some sericitization of the plagioclase (An_{34-70}) and complete alteration of orthopyroxene to chloritized serpentine. About 100 m above is another lava (P.1414.1), in which orthopyroxene is entirely altered and only a little fresh clinopyroxene remains. In this lava extensive sericitization and calcitization prevents plagioclase composition determination. The alteration in specimen P.1413.1 is of a similar nature. Specimen P.1412.1 is the most altered lava sampled and it consists almost entirely of chlorite (penninite), calcite, epidote and secondary potash feldspar. It can be seen from these rock descriptions that there is:

i. A progressive increase in the intensity of the alteration towards the north-west throughout the rocks sampled.
ii. No marked change in mineralogy which would suggest a long time gap.

These two points and the field observations strongly suggest that there is no major unconformity present. At Admiralen Peak there is merely one pile of volcanic rocks which, after they had been deposited, were intruded and altered by the Crépin Point–Wegger Peak pluton

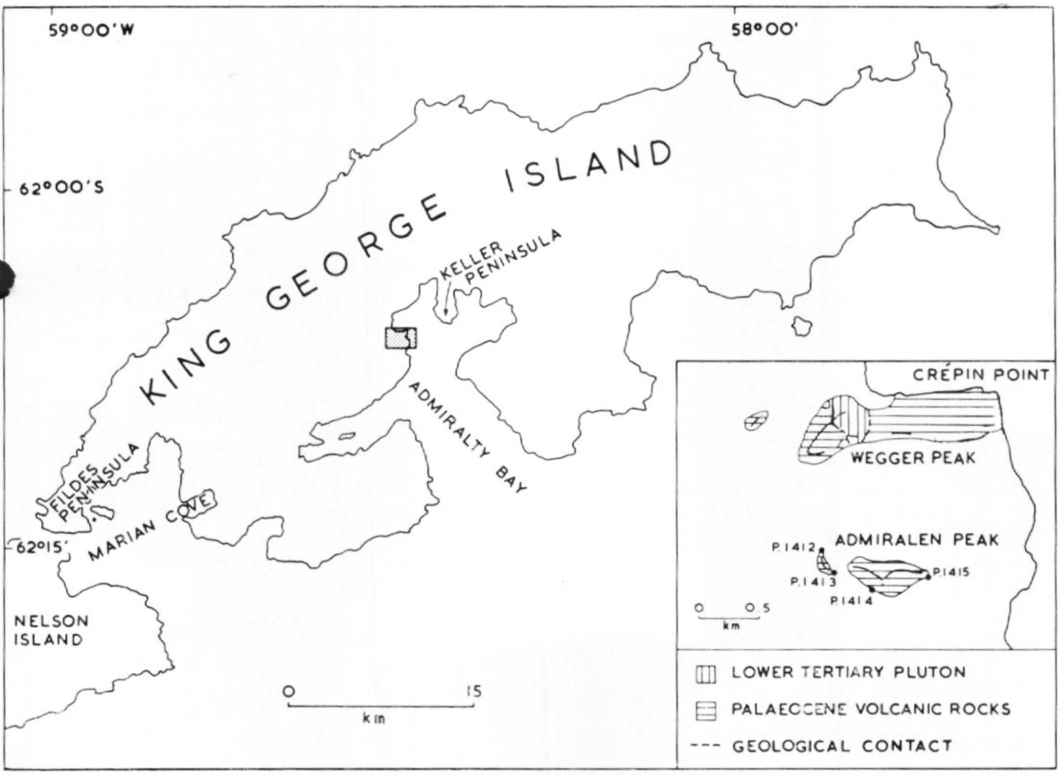

Fig. 1. Location map of King George Island. The inset is a geological sketch map of the Admiralen Peak area. Geological data for Wegger Peak from J. L. Smellie.

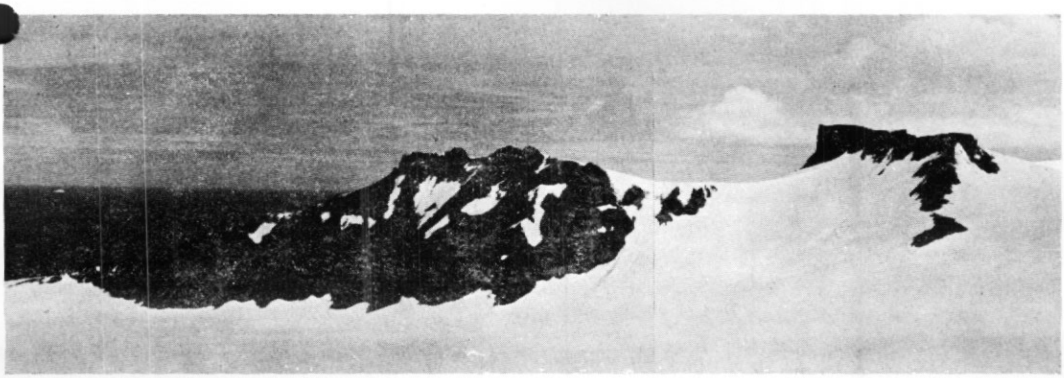

Fig. 2. Photograph of Admiralen Peak from Wegger Peak. (Photograph by J. L. Smellie.)

or an extension of it. No radiometric ages are available for these rocks but they can be compared with rocks from the Marian Cove area (Davies, 1982) and by analogy they are assigned a Palaeocene age. From the work of Schauer and Fourcade (1964), Grikurov and others (1970) and the author, it appears that there are no exposures of Tertiary rocks in juxtaposition with proven Jurassic rocks on King George Island.

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