which are quite old, remained unaffected even after two recent eruptions (1991 and 1995). This suggests that part of the island remained largely unaffected.

During the recent expedition, two NaHCO₃-type cold-water springs were recorded in the southeastern part of the island (Figure 1). These springs are located in a dry ‘nala’ (N 12°16’55.3”, E 93°51’05.5”) at a distance of 100 m from each other on the old caldera wall at an elevation of 65 m from the sea level. Waters from these cold springs were sampled and analysed and the data are given in Table 1. For comparison, drinking water standards recommended by the World Health Organization(6) are also given in Table 1. Although the name suggests that the Barren Island is devoid of inhabitation, life does exist on this island. The largest animals found here are the feral goats. Besides feral goats, rats, bats, crabs and birds also live on this island. Under what circumstances did the feral goats make their way to Barren Island is an unanswered question. However, it is believed that they were left by a steamer way back in 1891 (ref. 2). Morphologically, feral goats are like their counterparts in other places. They are medium-sized, short-legged, black to grey coloured with thick, coarse, dry and lustreless hair coat. What makes them significant is their adaptation to the harsh and inhospitable conditions and instinct for survival in this island.

The old caldera wall that has good vegetation cover is the source of sustenance for the feral goats. These goats were found grazing around these springs, which are probably the only freshwater source on this island. Further, these goats made a small animal track from the spring source to the crest of the caldera. With the discovery of these cold springs in the Barren Island, myths about the life of feral goats have been resolved.

The freshwater reservoir is possibly entrained in the pyroclastic (cinder) formations. The flow rate when the field work was carried out was ~1 l/min. The lower permeability of the pyroclastics (cinder) with respect to that of the lava formations allows a low discharge rate of the entrapped meteoric waters. There is a possibility of locating several such cold springs towards the steep slopes (seaward side) of the old caldera. Detailed work on the isotopic signatures of the water samples is underway and the results will be published elsewhere.


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Aerospora over Southern Ocean and Schirmacher oasis, East Antarctica

Geographical distribution of air-borne organisms over long distances by Sirocco and trade winds was demonstrated as early as 1846. During 1873, a study of dust samples collected near the Cape Verde Island resulted in the recording of sixty-seven different kinds of microorganisms(1,2). A study was conducted during 1937 over the Atlantic Ocean and a number of pollen and spores were recorded from the atmosphere(3). However, little information is available on the aerial transport of microbes into the Antarctic environment, including their viability, duration of suspension and gravitational settlement. In view of this, the Scientific Committee for Antarctic Research (SCAR) and BIOTAS have promoted aerobiology as a component of the ongoing international research programme. As a result of the review work undertaken during 1967, the principles governing long-distance transport of pollen grains and other microbota were seriously considered(4).

As of now, no aeropalinological data from polar atmosphere are available in the context of the Indian expedition to Antarctica since 1981. However, few sticky slides were exposed during the third Indian expedition to Antarctica over the Southern Ocean, which registered a fair range but sparse population of bioaero-
sols. Inspired by these results, one of us (S.K.B.) carried out further detailed study of aerspora spread over two and half months of stay at the Schirmacher oasis during the XIX Indian Antarctic expedition (1999–2000), and to and fro journey from Capetown to Maitri (Indian Research Station), East Antarctica (Figure 1). This communication reports the recovery of patterns of differential dispersal of microbionta in the polar atmosphere.

The Schirmacher oasis is an ice-free area situated in the Princess Astrid coast of Queen Maud Land, East Antarctica and lies between 70°44′33″–70°46′30″S lat and 11°22′04″–11°54′00″E long; it is 3800 km SE of Capetown, South Africa. The oasis is located between the margin of an ice sheet and shelf ice, the low-lying hills up to 250 m high, interspersed with glacial lakes and ponds and occupies an area of about 35 km². These lakes receive their sediment supply during warmer periods of spring and summer through snow melt run-off. It has emerged as a rock oasis, 20 km long and 3.5 km wide. The surface of the oasis is undulating, the gentle slopes and plain areas are covered with mostly thin blanket of moraine debris which allows luxuriant growth of moss turfs and lichens. The lakes and ponds in the region cover a total area of about 3 km², representing an essential component of surface water. Annual mean temperature varies between –8 and –10°C. January is the warmest month (0.5 to 0.8°C) and August, the coldest (–18 to –22°C). There is frequent depression which travels predominantly between 50 and 70°S lat that causes katabatic winds which accelerate to strong blizzards for several hours on certain days, and could exceed 200–300 km per hour in winter.

Antarctica is almost barren floristically, with only two existing vascular plant species, viz. Deschampsia antarctica (Poaceae) and Colobanthus quitensis (Caryophyllaceae); among lower plant groups such as mosses Polytrichum alpinum, Drepnaculoides uncinatus are frequent. There is preponderance of aquatic algae and various lichens that grow in moist, rocky stratum and near water bodies.

Air sampling was performed using Burkard personal slide sampler which is a compact battery/power-operated machine (height 10 cm and diameter 8 cm). It has a rectangular orifice at the top and a slit on the side to insert an adhesive-coated microslide. The sampler sucks in air at the rate of 10 l/min through the orifice and the particles, if any, get impinged onto the slide in the form of a band. Microslides (75 mm × 25 mm) of 0.8 mm thickness were used. Three-fourth of the slide was smeared with glycerine jelly in the form of a thin film. The labelled slide was inserted through the slit in the sampler with the jelly side upward, and the lid was twisted to seal the inner chamber. For mounting, the glycerine jelly was melted on a hot plate and a drop was placed on the exposed band of the slide. Warm cover glass was placed on this drop of molten glycerine jelly. Slides were exposed for a 10-min period in the morning (9–10 GMT). During voyage, the slides were exposed at the topmost part of the ship deck, while during the stay at Maitri, they were exposed near the windmill of the National Aeronautical Laboratory research site (Figure 2). Day-to-day meteorological data were collected from the India Meteorological Department personnel deputed to the expedition.

Figure 1. Location of sampling sites at Schirmacher oasis, E. Antarctica.

Figure 2. Air sampling near Maitri, Schirmacher oasis, East Antarctica.
mid species was well represented (9/m³).
There were certain unidentified pollen grains and fungal spores which probably belonged to Deuteromycetes and Asco-
mycetes. The other main constituents of aerospora were fungal hyphae, fruiting body, plant fragments and insect body parts (Figure 3).

There is limited evidence to support long-distance transport of pollen and spores by westerly winds across the circum Antarctic ocean. Presence of fungal spores at Maitri station may be accounted for by their parasitic/saprophytic relationship with the surrounding vegetation which mainly comprise moss and lichen species growing in the ice-
free area. The occurrence of air-borne palynodebris deposited in surface sediments (moss tufts) near the Zuh lake at Maitri partially supports the present findings. The adherence of grass and Asteraceae pollen in the samples is indicative of fresh pollen release from the plants of nearby islands. Although information on the biogeographical distributions of species in the circum-Antarctic region is incomplete, the plant species at Marion Island (treeless vegetation consists mainly of mire and bog communities dominated by bryophytes and graminoid) show strong affinities with those of the Kerguelen Province (upland wind desert dominated by cushion plants), the sub-Antarctic phyto-
geographical province to which the islands belong.

The occurrence of pollen-spores and varia even in low frequencies in the present study suggests regular transport of microbiota in the polar atmosphere by the prevailing westerly winds across the circum-Antarctic Ocean. Compared with air over land, the concentration of such propagules in surface layers over the sea is usually small. However, processes by which marine organisms become airborne include spray droplets from the breaking of waves at sea, foam blown-off white caps, and bursting of bubbles produced by white caps, rain or snow. There is currently only limited data on airdsora over the Southern Ocean as well as in the Antarctic mainland. We believe that this attempt would be helpful in building up the database on the pattern of distribution of microbiota in the polar atmosphere. The data will be of immense help to the Quaternary pollen analysts for interpretation of pollen-spore data in relation to palaeowind in and around the

Figure 3. Palynomorphs recorded from air catches (all figures x 1000). a, Poaceae; b, Germin-
ating fruiting body; c, Ascospore; d, Cyperaceae; e, Asteraceae 1; f, Oleaceae (broken); g and h, Developing Alternaria; i, Curvularia; j, Cosmarium (one semi cell); k, Haplosporella; l, Un-
identified; m, Alternaria; n, Conidiophore.

Ten minutes exposure of the slides exhibited scanty picture of aerobiota. Amongst fungal spores, ascospores (25/m³) were the dominant group followed by rust spores (24/m³), Alternaria (16/m³), Helminthosporium (11/m³) and Curvularia (6/m³). Other spores such as Haplosporella (3/m³), Cladosporium (2/m³), Memnioniella (1/m³) and conidiophore (1/m³) were poorly represented. Amongst pollen grains, one member of Poaceae (20/m³) was the dominant group followed by Cheno/Ams type (11/m³); other groups were Asteraceae 1 (7/m³), Asteraceae 2 (5/m³), Oleaceae (4/m³) and Cyperaceae (3/m³). Cosmarium – a des-
polar region. Our current knowledge of oceanic and terrestrial airspora, including the nearby islands is fragmentary and requires systematic exploration.


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Erratum

**SPOT VEGETATION multi temporal data for classifying vegetation in south central Asia**

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Figure 2 should appear as below.