# The Early Development of Freshwater Biota on Surtsey

by

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On June 1 and 2, 1967, 11 aquatic organism traps were sterilized with 50% ethanol (denatured with methyl violet and pyridine) and placed in various locations on the lava fields of Surtsey. These traps were made of polyethylene and are about 80 cm long, 50 cm wide and 30 cm deep (they were sold as laundry tubs). Pieces of lava were placed over the edges of the traps so that the winds would not blow them away. It is anticipated that these traps will fill with rain water and provide 11 isolated habitats in which the process of colonization by fresh water algae, protozoa, and micro-metazoa can be followed.

On June 1, 3 and 5 air was sampled by holding up petri plates containing sterile agar (made with Bold's Basal Medium), and on the 3rd air samples were taken with a rotorod sampler (some rods were covered with agar and others with silicone stopcock grease as adhesive). These sampling techniques have been shown to be effective in the capture of airborn dissemules of the freshwater and soil algae (Brown, Larson and Bold, 1964). Wind velocities were about 55 knots on June 1, 15 knots on June 3, and 5 knots on June 5; intermittant rain fell during the days on which the samples were taken, but only on June 5 was any rain caught on the agar surface (and then only a little from the leading edge of a shower).

On June 4, a series of ash samples were taken from 8 points in a transect on the NNE side of the island, from just above the beach to the highest point of the ash. Samples of these were cultured in artificial lake water (Maguire, 1963), Bold's Basal Medium, sea water culture medium, and millipore filtered pond water. Some of the cultures were fed a few drops of an autoclaved suspension of dried, pulverized wheat leaf (Cerophyll) in distilled water. A similar series of ash samples were taken on August 13; they were cultured as outlined above.

In June, a depression in the ash of the east side of the island was deepened and lined with a sheet of polyethylene, a 5-8 cm layer of ash was spread on this sheet, a second sheet was added, and in turn covered with an ash layer. It was hoped that water would collect in this depression to produce a pond of about 2 by 4 m. At one time there was water in the depression, but it did not last long, either because capillarity permitted the water to drain out through the ash or because the bottom was punctured even though it had been made of double layer construction.

Collections were made from each of the 11 traps during the second week of August. At this time only 4 of the traps contained water (the summer had been unusually dry and the traps had not been put on Surtsey in time to take advantage of the winter rains). Water samples were examined immediately after collection and then divided into subsamples, some of which were fed with Cerophyll suspension. Ash samples were taken from the dry traps, all of which had had water in them at some time between early June and mid August. Subsamples of ash and water were given to Dr. Harold C. Bold, a phycologist, and to Dr. Stuart S. Bamforth, a protozoologist; I have others cultured (as outlined above) and have examined them periodically. Soil samples were kindly obtained by Mr. Sigurdur H. Richter from islands between Surtsey and Iceland (Geirfuglasker - nearest Surtsey, and Dyrhólaey (Portland) an island very near to mainland and now connected to it by a wide beach). These samples were subdivided and treated as outlined above.

## Results

More data and more detailed information on the species of small aquatic organisms in the ash and the traps (excluding bacteria and protozoa) will be available when culture studies are complete. Information obtained to this date is summarized below:

1. Except for bacteria and fungi (of which there were many colonies), no freshwater organisms grew from the cultures of air and rain samples.

2. Cultures from the ash transect extending from slightly above sea level (1) to the top of the ash hill (8) contained the following:

Samples of June 4, 1967: nothing except for moss protonema in 2, 3, 4 and 8.

Samples of August 13, 1967:

1. Stichococcus (in fresh water and salt media)
   Dunaliella
2. Chlamydomonas
3. Chlorococcum
   Stichococcus
   Dunaliella
4. Chlorella like
5. Chlamydomonas (2 spp)
6. none
7. none
8. none

3. From the traps (no. 3, 4, 5 and 10 contained water):

Samples of August 14, 1967:

1. none (salty?)*
2. none*
3. Anabaena
   Fasciculochloris
   Chlamydomonas
   Oicomonas
   Bodo
   Cercobodo
   Mayorella
   Hartmannellidae or Vahlkampfiidae
   Small filose Rhizopod
   Euchelys (?)

   Contained bird feathers, faeces, pieces of marine crustacea brought in by birds.

4. Chlamydomonas
   Chlorococcalian alga
   Monas
   Bodo
   Amphimonas (?)
   Cercomastax (?)

5. Nannochloris
   Chlorococcalian alga
   Monas
   Bodo
   Oicomonas
   Amphimonas

6. none

7. Bodo
   Colpoda

8. none

9. none

10. Chlamydomonas
    Chlorella like alga
    Cercobodo (?)
    Oicomonas

11. none*

4. The cultures from soil samples from intermediate islands contained:

Geirfuglasker (top): Tetracystis
Chlorococcum
moss
Monas
Bodo no. 1
Bodo no. 2
Cercomastix
sm. zooflagellate
v. small Actinopod

* Cultures have not yet been completely examined (Dr. Bamforth is now working on them).

Holotrich no. 1
Holotrich no. 2
Oxytrichidae
Rhabdostyla
Nematode

Dyrhólaey (top and bottom combined):

Nodularia
Chlamydomonas
Tetracystis
Chlorococcum
Chlorella
Bumillaria
Spongiochloris
Hormidium
Entocladia (in marine medium)
Pinnularia
Monas
Gymnostome
Colpoda
Hypotrichina

## Discussion

There was an average of 6.75 different species in the samples from traps which contained water, and an average of only 0.5 species in those were dry. The higher number in the wet traps could be caused by differential efficiency in the trapping of dissemules of aquatic organisms by traps which contained water for different lengths of time and/or by a high mortality which might have occurred as evaporation proceeded in the drying traps with the result that they became highly saline as the amount of water decreased toward zero.

The early development of freshwater communities in the traps has been very rapid considering their isolation and their unnatural character. This high colonization rate is additional support for the conclusion that many small aquatic organisms have very efficient

dispersal mechanisms. It is too early to see developmental patterns of these communities; within the next few years, however, a fascinating story should unfold.