Ecology of the Subantarctic Islands

Chairman: Dr. R. A. Falla

Geological History

Dr. C. A. Fleming

The geological history of Campbell Island is better known than that of other subantarctic islands because its stratigraphic record is more complete (Oliver, 1950). Apparently the site of Campbell Island was land in the Upper Cretaceous and shared in the peneplanation that reduced the relief of older rocks in southern New Zealand at that time, producing extensive alluvial plains of quartz gravels. The Campbell Island quartz gravels required long transport and chemical weathering for their formation so that the island probably formed part of a large land area. From such geological evidence it might have been linked with New Zealand but Upper Cretaceous pollens and spores from Campbell Island recently studied by R. A. Couper lack the conifer and beech pollens so abundant in the New Zealand Cretaceous, indicating a dispersal barrier, climatic or geographic, between New Zealand and Campbell Island.

The sea encroached on the Cretaceous peneplain in the Teurian (latest Cretaceous) and covered Campbell Island throughout the Paleocene, Eocene and early Oligocene, depositing globigerina ooze, beyond the influence of terrigenous sediments and thus distant from continental shelves of land. The record is interrupted during the Miocene. In the late Miocene or early Pliocene, a volcano broke through the domed-up Tertiary sediments. Its earliest deposits are marine breccias that eventually built up to sea level and were capped by the lavas of modern Campbell Island. There is no geological evidence for land connection between New Zealand and Campbell Island since the Pliocene volcano emerged from the sea, but its vegetation during early stages of vulcanism, judged by abundant pollen, contained extinct *Nothofagus* and *Triorites* (? Betulaceae) and rare *Metrosideros*, suggesting ready access for these trees.

Subsequently, Pleistocene glaciers extended below present sea-level, so that even if the sea receded 100 miles at the same time, only vegetation tolerant of sub-alpine conditions could have persisted.

Other subantarctic islands have such fragmentary records that their history is very speculative. Auckland Islands were built as volcanoes about the same time as Campbell Island and were also severely glaciated in the Pleistocene. Pleistocene sea retreats are unlikely to have linked the islands (except perhaps the Snares) with New Zealand.

The effects of geological factors on subantarctic ecology include the following: (1) Elimination of Tertiary organisms that could not stand severe glaciation. (2) Consequently, survivors of the Pliestocene are tolerant of extreme conditions. (3) Being the oldest elements, such survivors should include the most endemic groups. (4) Northern elements near their limits of tolerance in the subantarctic are probably post-Pleistocene immigrants. (5) Post-Pleistocene immigrants must have had high dispersal ability to reach the islands. (6) The present subantarctic communities (composed of Tertiary relicts reinforced by post-Pleistocene immigrants selected from the fauna and flora of source areas on account of high vagility) seem unbalanced, lacking elements normally found in similar communities. Such unbalance is typical of communities on oceanic islands.

REFERENCES

OLIVER, R. L. 1950. Preliminary report on the geology of Campbell Island. *Cape Exped. Ser. Bull.* 3. 7-44.