

NOTHOFAGUS AND OTHER TREES STRANDED ON ISLANDS IN THE ATLANTIC SECTOR OF THE SOUTHERN OCEAN

R. I. LEWIS SMITH

*British Antarctic Survey, Natural Environment Research Council, High Cross,
Madingley Road, Cambridge, CB3 0ET, UK*

ABSTRACT. The occurrence of driftwood, predominantly of Southern South American provenance, on Beauchêne Island, South Georgia, the South Sandwich and the South Shetland islands, is reported. Of 56 specimens examined most belonged to species of southern beech, *Nothofagus*, particularly *N. pumilio*. The importance of such driftwood on remote islands is discussed with regard to its potential for transporting terrestrial organisms over great distances and serving as possible agents of biological immigration and colonization.

Driftwood has been observed in many treeless northern polar regions since the earliest exploration of the Arctic. In some areas it is so plentiful that it has been commercially exploited (see Euroala, 1971). In the southern hemisphere, several instances have been reported of natural driftwood (Halle, 1912; Baker, 1924; Matthews, 1931; Christopherson, 1939; Barber and others, 1959; van Zinderen Bakker, 1971; Longton, 1977; Smith and Prince, in press), seeds (Costin, 1965) and pumice (Sutherland, 1965; Coombs and Landis, 1966; Smith and Prince, in press) being washed ashore on southern cool temperate and sub-Antarctic islands and the South Sandwich Islands. Tree trunks and branches are frequent on South Georgia and occur rarely on islands in the northern maritime Antarctic. However, on these islands, and particularly the former, logs bearing saw or axe marks, and other timber obviously dressed and discarded from ships, are also frequently encountered. Samples of 56 tree trunks, branches and other pieces of timber found on these islands have been identified and some details are provided in Tables I and II.

Halle (1912) reported large amounts of buried wood at 14 sites in the Falkland Islands around West Point Island Harbour off West Falkland Island, suggesting that this represented a sub-fossil forest bed. However, Baker (1924) believed these tree trunks, all of which have been found in a horizontal position, to be driftwood since they are all close to, or embedded in, beaches, and stated, 'Most geologists who have seen the wood declare it to be drift-wood'. He also noted tree trunks stranded on beaches in Bull Cove in the south-west of East Falkland Island. On Beauchêne Island, 80 km south of East Falkland Island, several dozen trees occur, mainly on two boulder beaches on the west coast, particularly in a broad bay in the southern half of this small island (Smith and Prince, in press). Some are embedded in peat near the margin of the tussac grassland, up to 10 m above and 50 m inland from the normal high water mark. Those sampled were *Nothofagus betuloides*, *N. obliqua* and *N. pumilio* (Fagaceae). Several were radiocarbon dated at between about 250 and 500 years BP, yet the trees themselves were estimated to be no more than 100 years old. It is possible that the trunks had been on the island for several hundred years, washed high above the water mark by storms from the west.

On South Georgia, tree trunks and accumulations of driftwood have been found in several bays, mainly along the south coast. Matthews (1931, p. 14) commented on various timbers stranded on the island. Referring to a small cove on the north shore of King Haakon Bay, he noted, 'On one of the beaches lies a large tree trunk, white with exposure; probably it arrived as driftwood from the neighbourhood of Cape Horn; it certainly would not have been brought by shipping as it is too gnarled and

twisted to be of any use'. Matthews (1952, p. 72) later added that, 'the top of the beach and the edge of the flats above the seal rookery were piled with wreckage – tons and tons of wood. . . But strangely out of place. . . were the trunks and limbs of several trees, one with the root stumps at the butt. They were some kind of hardwood, every trace of bark long since gone, and very much weathered; there were no marks upon them to show that they had ever been touched by edge tools. . . The gnarled and twisted tree trunks certainly must have drifted from where they grew for no one would have brought such crooked, useless timbers across the ocean. . . Much of it may well have been there a century – or more'. He also drew attention to the large amount of driftwood that litters beaches in the Ice Fjord–Wilson Harbour area (Matthews, 1931, p. 14). On the north shore of Middle Bay at the head of Ice Fjord, he noted, 'Middle Bay is the most exposed and beset with rocks. Behind this beach lies a quantity of driftwood and wreckage, probably drifted from the neighbourhood of Cape Horn, like that in King Haakon Bay'. Of the specimens sampled, most have been identified as *Nothofagus betuloides*, *N. pumilio*, *N. cf. obliqua*, or unidentified species of *Nothofagus*.

Longton (1977) discussed the occurrence of a large tree trunk bearing branches of Candlemas Island, South Sandwich Island. It had been identified as *N. cf. menziesii*, a New Zealand taxon. However, a recent re-examination of the same sample and of wood from another log from the same locality revealed the former to belong to *N. betuloides* (which resembles *N. menziesii* by the absence of spiral thickening on the vessel walls, and by shorter rays which are often biseriate) and the latter to *N. pumilio*. Several tree trunks have been observed in the South Shetland Islands, notably on Byers Peninsula, Livingston Island. One example from a raised beach in the locality has been sampled (Fig. 1); it was identified as *N. obliqua*. Another gnarled tree trunk several metres long was found about 1 km south-east of Harmony Point, Nelson Island



Fig. 1. Trunk of *Nothofagus obliqua* embedded in a raised beach terrace at the northern end of Robbery Beaches, Byers Peninsula, Livingston Island, South Shetland Islands. (Photo J. L. Smellie.)



Fig. 2. Trunk of *Nothofagus* sp. embedded in a raised beach terrace south-east of Harmony Point, Nelson Island, South Shetland Islands. (Photo J. L. Smellie.)

(Fig. 2). The sample taken has not been positively identified but belongs to the genus *Nothofagus*.

In addition to the species of *Nothofagus* listed in Table I, several other tree taxa from various localities on the south side of South Georgia have been provisionally identified. Some of these timbers were obviously of shipborne origin, being dressed poles or beams. For completeness, these taxa are presented in Table II. Apart from two specimens of spruce and one of cedar, all were of southern South American provenance. It is uncertain whether the shorter branches of both these genera and of the *Nothofagus* spp. were genuine driftwood or had been discarded from ships, although it is unlikely that irregularly shaped short pieces of wood would have served any purpose on a ship. However, such timber may have been brought to the island in the sealing era of the early 1800s for use as firewood or for constructing temporary encampments near sealing beaches. It is of interest to note here the occurrence on Macquarie Island of two southern South American species, namely *Encryphia cordifolia* and *Fitzroya patagonica* (H. N. Barber, pers. comm.).

Table I. Details of the *Nothofagus* logs sampled.

Specimen no.	Locality	Species	Notes
1	Beauchêne Island*	<i>Nothofagus pumilio</i>	3 m inland from the tussac margin. Length 3 m; diameter 16 cm at 30 cm from the base. Radiocarbon age 540 ± 40 yr BP.
2	Beauchêne Island	<i>Nothofagus betuloides</i>	1 m inland from the tussac margin. Length 3.85 m; diameter 40 cm near base.
3	Beauchêne Island	<i>Nothofagus obliqua</i>	1 m inland from the tussac margin. Length 10.8 m; diameter 50 cm at 1 m from a spreading base, 30 cm at 10 cm from the base. Radiocarbon age 210 ± 40 yr BP.
4	Beauchêne Island	<i>Nothofagus betuloides</i>	At margin of tussac vegetation. Length 4.9 m; diameter 30 cm at 30 cm from base.
5	Beauchêne Island	<i>Nothofagus pumilio</i>	At margin of tussac vegetation. Length 6.8 m; diameter 40 cm near base.
6	Beauchêne Island	<i>Nothofagus pumilio</i>	20 m inland from the tussac margin at north end of storm beach. Length 3.75 m; diameter 25 cm (maximum). Radiocarbon age 250 ± 40 yr BP.
7	Beauchêne Island	<i>Nothofagus pumilio</i>	As 6. Length 1.5 m; diameter 30 cm (maximum). Radiocarbon age 280 ± 60 yr BP.
8	Beauchêne Island	<i>Nothofagus obliqua</i>	Irregular branch lying above rocks below main albatross and penguin colony to north of storm beach. Length c. 2.5 m; diameter c. 6 cm.
9	South Georgia, Bird Island	<i>Nothofagus betuloides</i>	On beach c. 50 m inland from and 1–2 m above high water mark. Freshwater Inlet. Length c. 8 m; diameter c. 45 cm. Coll. J. Smith, 7 Jan. 1958.
10	South Georgia, Bird Island, Johnson Cove	<i>Nothofagus</i> sp.	Trunk on beach above high water mark. Coll. R. I. Lewis Smith, Jan. 1970.
11–12	South Georgia, Bird Island	<i>Nothofagus</i> sp.	No data. Coll. W. N. Bonner, Dec. 1958.
13	South Georgia, Bird Island	<i>Nothofagus</i> sp. (? <i>N. obliqua</i>)	No data; spiral thickening in vessels, but differs from <i>N. pumilio</i> . Coll. W. N. Bonner, Dec. 1958.
14	South Georgia, Bird Island	<i>Nothofagus pumilio</i>	Part of a larger log; specimen sampled 75 cm \times 26 cm. Coll. W. N. Bonner, Dec. 1958.
15	South Georgia, Bird Island	<i>Nothofagus</i> sp. (as No. 12)	Relatively straight (?dressed) log, 120 cm \times 6 cm. Coll. W. N. Bonner, Dec. 1958.
16	South Georgia, Bird Island	<i>Nothofagus pumilio</i>	Tree base with remains of roots, forking at 1 m from base; 2.5 m long, 10 cm diameter at base. Coll. W. N. Bonner, Dec. 1958.

17	South Georgia, Bird Island	<i>Nothofagus pumilio</i>	Piece, 87 cm × 18 cm. Coll. W. N. Bonner, Dec. 1958.
18	South Georgia, Bird Island	<i>Nothofagus pumilio</i>	Trunk or branch, 3.94 m long, 18 cm wide at base, 11 cm wide at tip. Coll. W. N. Bonner, Dec. 1958.
19	South Georgia, Bird Island	<i>Nothofagus pumilio</i>	Club-shaped branch or stump, 1.87 m long by 6.5 cm wide at tip. Coll. W. N. Bonner, Dec. 1958.
20	South Georgia, Bird Island	<i>Nothofagus</i> sp.	Very knotted branch. Coll. W. N. Bonner, Dec. 1958.
21	South Georgia, north-east Schlieper Bay	<i>Nothofagus</i> sp.	Trunk 1–2 m above high water mark; c. 6–7 m long by 40–50 cm diameter at base. Coll. R. I. Lewis Smith, Jan. 1977.
22	South Georgia, Wilson Harbour	<i>Nothofagus</i> sp.	Trunk with broken ends, much weathered, 4.5 m long by 30 cm wide; no spiral thickening in vessels. Coll. W. N. Bonner, Nov. 1958.
23	South Georgia, Wilson Harbour	<i>Nothofagus</i> sp.	Curved branch, broken at ends, 2.10 m long, 9 cm wide; no spiral thickening in vessels. Coll. W. N. Bonner, 2 Nov. 1958.
24	South Georgia, Wilson Harbour	<i>Nothofagus</i> sp.	Irregular piece, much rounded by sea action, 17 cm long; spiral thickening in vessels. Coll. W. N. Bonner, 2 Nov. 1958.
25	South Georgia, Wilson Harbour	<i>Nothofagus</i> sp.	Irregular piece, 23 cm long; no spiral thickening in vessels. Coll. W. N. Bonner, 2 Nov. 1958.
26	South Georgia, Wilson Harbour	<i>Nothofagus pumilio</i>	Branch, broken at ends, 1.65 m long. Coll. W. N. Bonner, 2 Nov. 1958.
27	South Georgia, Wilson Harbour	<i>Nothofagus pumilio</i>	Piece of branch, 15 cm long. Coll. W. N. Bonner, 2 Nov. 1958.
28	South Georgia, King Haakon Bay, north side opposite Vincent Islands	<i>Nothofagus betuloides</i>	On beach c. 10 m inland from and 2 m above high water mark. Coll. R. I. Lewis Smith, 28 Dec. 1970.
29	South Georgia, King Haakon Bay, Cheapman Bay, opposite McNeish Island	<i>Nothofagus pumilio</i>	Several metres from the high water mark. Length 7 m; diameter 40 cm. Coll. R. I. Lewis Smith, 28 Dec. 1970.
30	South Georgia, King Haakon Bay, cove to east of Cape Rosa	<i>Nothofagus</i> sp.	Trunk c. 2 m above high water mark. Coll. R. I. Lewis Smith, 28 Dec. 1970.
31	South Georgia, King Haakon Bay	<i>Nothofagus</i> sp.	Trunk with bark intact, broken at ends, 1.20 m long by 12 cm; no spiral thickening in vessels. Coll. W. N. Bonner, 3 Nov. 1958.
32	South Georgia, King Haakon Bay	<i>Nothofagus pumilio</i>	Branch, 1.20 m long. Coll. W. N. Bonner, 3 Nov. 1958.
33	South Georgia, King Haakon Bay	<i>Nothofagus pumilio</i>	Trunk, including root stock, 6 m long by 75 cm diameter near base. Coll. W. N. Bonner, 3 Nov. 1958.

Table I. *cont.*

Specimen no.	Locality	Species	Notes
34	South Georgia, King Haakon Bay	<i>Nothofagus pumilio</i>	Branch, broken at ends, 1.05 m long. Coll. W. N. Bonner, 3 Nov. 1958.
35	South Georgia, King Haakon Bay	<i>Nothofagus pumilio</i>	Branch, 1.50 cm. Coll. W. N. Bonner, 3 Nov. 1958.
36	South Georgia, King Haakon Bay	<i>Nothofagus pumilio</i>	Piece, 75 cm long by 17 cm wide. Coll. W. N. Bonner, 3 Nov. 1958.
37	South Georgia, Queen Maud Bay, Shallop Cove, south side	<i>Nothofagus pumilio</i>	Trunks with partial branch and root system. On rocks c. 5 m inland from and 1–2 m above high water mark. Length c. 6 m; diameter of bole c. 75 cm. Coll. R. I. Lewis Smith, 30 Dec. 1970.
38	South Georgia, Jossac Bight, Horten	<i>Nothofagus pumilio</i>	Several metres from high water mark. Length 4 m; diameter c. 60 cm. Coll. D. W. H. Walton, Jan. 1974.
39	South Georgia Larvik	<i>Nothofagus betuloides</i>	Several metres from high water mark. Length 5 m; diameter c. 30 cm. Coll. D. W. H. Walton, Jan. 1974.
40–42	South Georgia, unspecified localities south side of island	<i>Nothofagus pumilio</i>	No information.
43	South Sandwich Islands, Candlemas Island, near Carbon Point	<i>Nothofagus betuloides</i>	Trunk clothed in bark and possessing branches. Embedded in raised beach c. 40 m inland from and 3–4 m above high water mark. Length c. 4 m; diameter 34 cm near the base. Coll. R. E. Longton, 12 March 1964.
44	South Sandwich Islands, Candlemas Island, near Carbon Point	<i>Nothofagus pumilio</i>	On raised beach c. 40 m inland from and 3–4 m above high water mark. Coll. R. E. Longton, 12 March 1964.
45	South Shetland Islands, Livingston Island, Byers Peninsula, Robbery Beaches	<i>Nothofagus obliqua</i>	Trunk with branches, embedded in raised beach c. 50 m inland from and 2 m above high water mark. Length c. 5 m diameter c. 1 m at base. Coll. J. L. Smellie, 1974.
46	South Shetland Islands, Nelson Island, south-east of Harmony Point, Harmony Cove	<i>Nothofagus</i> sp.	Trunk embedded in raised beach, c. 100 m inland and 3–4 m above high water mark. Length c. 3.5 m, diameter c. 75 cm at a base. Coll. J. L. Smellie, 1974.

* All Beauchêne Island specimens collected from bay on mid-west coast from 50–60 m inland from and 8–10 m above high water mark, by R. I. Lewis Smith, 12 Dec. 1980.

Table II. Details of miscellaneous timbers stranded on the south side of South Georgia.

Specimen no.	Locality	Taxon	Notes
47	Bird Island	Podocarpaceae (<i>Podocarpus</i> sp.)	No data.
48	Bird Island	Pinaceae (<i>Picea</i> sp.)	Dressed pole, 69 cm × 6 cm.
49	Bird Island	Pinaceae (<i>Picea</i> sp.)	Dressed spar, surface much frost or water damaged, 4.90 m by 28 m diameter.
50	King Haakon Bay	Epacridaceae	Very twisted branch, 60 cm long.
51	King Haakon Bay	Escalloniaceae	Twisted branch, 38 cm long.
52	King Haakon Bay	Cunoniaceae (? <i>Weinmannia trichosperma</i>)	Branch with rough ends, 165 cm long.
53-54	King Haakon Bay	Winteraceae (? <i>Drimys winteri</i>)	Part of branches, 90 and 43 cm long.
55	King Haakon Bay	Meliaceae (? <i>Cedrela toona</i>)	Part of dressed beam, 4.5 m × 45 cm × 45 cm.
56	Diaz Cove	Podocarpaceae (<i>Podocarpus</i> sp.)	Part of dressed beam, surface much frost or water damaged, 3 m × 23 cm × 23 cm. Possibly from a nineteenth-century wreck near here.

Bird Island specimens collected Dec. 1958; King Haakon Bay specimens collected 3 Nov. 1958; Diaz Cove specimen collected on 15 Nov. 1958. All specimens collected by W. N. Bonner.

The occurrence of these trees and miscellaneous timbers, almost all of which are of Fuegian or southern Patagonian provenance, on islands in the far South Atlantic Ocean and maritime Antarctic is not only of interest for their presence on remote islands but also because of their possible implication as agents of dispersal of terrestrial organisms, notably seeds and micro-arthropods. Such trunks may cross great distances, as has been shown by two logs of *N. pumilio* from Tristan da Cunha, 4500 km from their source (Barber and others, 1959), a log of *N. pumilio* found on Marion Island, c. 7000 km from its source (van Zinderen Bakker, 1971), and one of either *N. pumilio* or *N. obliqua* on the south-west coast of Tasmania and several of *N. pumilio* and *N. obliqua* on Macquarie Island, both c. 15500 km from their source (Barber and others, 1959).

The commonest tree identified in the samples discussed here is *Nothofagus pumilio*. This is also the dominant tree of the summer-green forests of south-eastern Tierra del Fuego, with evergreen *N. betuloides* forests increasing in the higher rainfall areas and occurring sparsely in the wet magellanic moorland (McQueen, 1976). Although *N. antarctica* is dominant in some lower precipitation areas as low forest or as sub-alpine scrub above the forest tree line, its trunk rarely reaches large dimensions and its wood appears not to be very durable (D. R. McQueen, pers. comm.). The identification of several timbers on the Southern Ocean islands as *N. obliqua* is perhaps surprising as its southern limit, according to Schmitusen (1969), is about 43° S in Chile. Consequently, if these determinations are accurate, the timber must have drifted against the Humboldt Current before reaching the West Wind Drift to transport it eastwards. Barber and others (1959) and Longton (1976) briefly discussed the biogeographical significance of such logs in relation to long-distance dispersal of organisms and subsequent colonization of isolated oceanic islands. Any investigation of the bark, if

it still exists, or surface of these tree trunks is unlikely to yield any useful information because it is not known how long they have been stranded on the islands and they are likely to have been contaminated by local plant propagules and invertebrates; many have undoubtedly been *in situ* for many decades. However, it is not inconceivable that seeds, spores, vegetative propagules or invertebrates lodged in rough bark of trees at their place of origin could remain there indefinitely, although the chance of them retaining their viability after what was probably a long period in the sea must be very small. Even if the diaspores or animals survive the ocean crossing they have then to transfer from the stranded log to a favourable habitat that they are capable of colonizing; the chance of this happening must be infinitesimally small. Flotation tests on seeds of many plants indigenous to Gough Island revealed that those of several species are capable of remaining afloat for several months in sea water. A few seeds of the native tree *Sophora macnabiana* germinated after three years in sea water (Wace and Dickson, 1965). Smith and Prince (in press) have suggested that the occurrence of weevil, belonging to the obligate timber-inhabiting wood-boring subfamily Cossininae, in *Nothofagus* trunks on Beauchêne Island may be descended from individuals dispersed to the island on logs originating from Tierra del Fuego or southern Patagonia. If this is true, the small population in several of the trunks may have been on the island for several hundred years according to the radiocarbon dates for the timber.

ACKNOWLEDGEMENTS

I am grateful to W. N. Bonner for providing information on his collection of driftwood specimens from South Georgia, and Drs H. E. Dadswell and H. D. Ingle, Division of Forest Products, CSIRO, Melbourne, Australia, for their determinations of these samples in 1959. I am also most grateful to L. Donaldson, Forest Research Institute, Rotorua, New Zealand, for providing the identifications of the remaining timber samples discussed in this paper, and also for his comments on the previously described specimen from Candlemas Island.

Received and accepted 24 October 1984

REFERENCES

- BAKER, H. A. 1924. *Final report on geological investigations in the Falkland Islands*. Stanley, Government Printer, 1-38.
- BARBER, H. N., DADSWELL, H. E. and INGLE, H. D. 1959. Transport of driftwood from South America, Tasmania and Macquarie Island. *Nature, London*, **184**, No. 4681, 203-4.
- COOMBS, D. S. and LANDIS, C. A. 1966. Pumice from the South Sandwich eruption of March 1962 reaches New Zealand. *Nature, London*, **209**, No. 5020, 289-90.
- COSTIN, A. B. 1965. Long-distance seed dispersal to Macquarie Island. *Nature, London*, **206**, No. 4981, 317.
- CHRISTOPHERSON, E., 1939. Problems of plant geography in Tristan da Cunha. *Norsk Geografisk Tidsskrift*, **7**, 362-8.
- EUROLA, S. 1971. The driftwoods of the Arctic Ocean. *Reports of the Kevo Subarctic Station*, **7**, 74-80.
- HALLE, T. G. 1912. On the geological structure and history of the Falkland Islands. *Bulletin of the Geological Institute of Uppsala*, **2**, 115-229.
- LONGTON, R. E. 1977. A *Nothofagus* log stranded on Candlemas Island, South Sandwich Islands. *British Antarctic Survey Bulletin*, No. 45, 148-9.
- MCQUEEN, D. R. 1976. The ecology of *Nothofagus* and associated vegetation in South America: Part I. *Tuatara*, **22**, No. 1, 36-68.
- MATTHEWS, L. H. 1931. *South Georgia: the British Empire's sub-Antarctic outpost*. Bristol, John Wright and Sons, and London, Simpkin Marshall.
- MATTHEWS, L. H. 1952. *Sea elephant: the life and death of the elephant seal*. London, MacGibbon and Kee.

- SCHMITUSEN, J. 1960. Die Nadelholzer in den Waldgesellschaften der Sudlichen Anden. *Vegetatio*, **9**, Nos. 4-5, 313-27.
- SMITH, R. I. LEWIS and PRINCE, P. A. In press. The natural history of Beauchêne Island. *Biological Journal of the Linnean Society*.
- SUTHERLAND, F. L. 1965. Dispersal of pumice supposedly from the 1962 South Sandwich Islands eruption, on southern Australian shores. *Nature, London*, **207**, No. 5004, 1132-5.
- WACE, N. M. and DICKSON, J. H. 1965. The terrestrial botany of the Tristan da Cunha Island. (In *Biology of the Tristan da Cunha Islands: Part II.*) *Philosophical Transactions of the Royal Society, Ser. B*, **249**, 273-360.
- VAN ZINDEREN BAKKER, E. M. 1971. Introduction. (In VAN ZINDEREN BAKKER, E. M., WINTERBOTTOM, J. M. and DYER, R. A. ed. *Marion and Prince Edward Islands*. Cape Town, A. A. Balkema, 1-15.)