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An historic album of New Zealand bryophyte specimens

Jessica E. Beever Manaaki Whenua - Landcare Research
John E. Braggins Auckland War Memorial Museum

Abstract
An album entitled 'New Zealand Mosses' was purchased by Auckland Museum from a London antiquarian bookseller in 2014. The album comprises 120 pages each with a mounted plant specimen. Of the specimens, 117 are bryophytes comprising 81 mosses, 35 liverworts and one hornwort. In addition, there are two seaweeds, one flowering plant, and one blank page. Almost all specimens are here identified to species level, and the remainder to genus level. The bryophytes are all common lowland species in New Zealand today. Locality of collection is given on all but two pages; they are principally from the northern North Island, but include the single South Island locality, Pelorus. All localities would be accessible from the coast. From the publication dates of the plant names used, production of the album is likely to have occurred between 1854 and 1867. A review of early bryological exploration of New Zealand is provided, as well as a discussion of moss collectors active in the mid-19th century. We provide evidence that the specimens in the album were collected by a traveller on H.M.S. *Pandora* during its part in the 1848–1856 Great Survey of New Zealand, perhaps by the ship's surgeon, Dr John Jolliffe.

Keywords
19th Century; Auckland Museum; bryophyte; moss album; New Zealand; John Jolliffe; H.M.S. *Pandora*

INTRODUCTION

In 2014 Auckland Museum purchased an album (Fig. 1) of pressed plant specimens from the London antiquarian booksellers Bernard Quaritch Ltd. It was described as 'A catalogue of New Zealand Mosses ca. 1850' (hereafter referred to as 'The Album'). Owing to the generosity of the seller, who believed the rightful place for this unique object was in New Zealand, the asking price of £2500 was reduced to £1,600.

Earlier the same year Auckland Museum had unsuccessfully bid for The Album at Bonhams Fine Art Auction 21752 'Printed Books, Maps and Photographs' in Oxford, 25 June 2014.

The catalogue details were as follows:

> Lot 364 NEW ZEALAND - MOSSES "New Zealand Mosses", [mid nineteenth century] estimate £200 – 300 "New Zealand Mosses", approximately 120 mosses mounted one per page (recto only), each with latin name and place of discovery in a neat miniscule hand, on stubs, contemporary green calf, upper cover with gilt borders enclosing the red morocco gilt lettering label on upper cover, 8vo, [mid nineteenth century] Footnotes: Bound in an unusual green calf wedge/ cheese-shaped binding, a collection of mosses from New Zealand, each identified with latin name and place found; Wangaroa, Hokianga River, Manukan [*sic*] Harbour, Bay of Plenty, Hick's Bay, Waiheki Island, Auckland, Pelorus, and others.

The present paper documents the identity of the plant specimens in The Album, provides evidence of The Album's date and speculates on its origin. Although having a cover title 'New Zealand Mosses', and although the majority of specimens are indeed mosses, approximately one third were found to belong to other plant groups, and four botanical specialists have contributed to this study. By way of context, a brief account of early bryological exploration in New Zealand is given.

METHODS

The specimens were studied by Jessica E. Beever (mosses), John E. Braggins (liverworts and hornworts), Wendy A. Nelson (seaweeds) and Ewen K. Cameron (vascular plant), in order to ascribe to each specimen its current botanical name.

The Album (Auckland Museum accession number 2015.6.1) and its contents were photographed in the Auckland Museum Herbarium. As pages are not numbered in The Album, the image numbers are used for reference, abbreviated to #001 to #125. All images

Figure 1. The Album 'New Zealand Mosses'. © Auckland Museum CC BY.

are available at https://commons.wikimedia.org/wiki/New_Zealand_Mosses. Many of the specimens could be identified to species level from the images. When this was not possible further study was made with the aid of a WILD M3C Heerbrugg Switzerland dissecting microscope mounted on a long arm. When necessary, and if it could be done without significant damage to the integrity of specimens, fragments were removed for examination of water mounts with a Leitz Laborlux 3 compound microscope. Thus, details of leaf structure were ascertained. These included, as appropriate for definitive identification, leaf marginal ornamentation, the nature of a costa, cell surface ornamentation, cell wall features, and toothing of any scale appendages.

Digitised versions of the *Flora Novae-Zelandiae* (Hooker 1854) and the *Handbook of the New Zealand Flora* (Hooker 1867) were accessed to research bryophyte names, collectors and localities, in order to obtain some insight into bryological activity in New Zealand in the mid-19th century, and to search for any comparability with The Album. The method has limitations owing to errors in transcription, e.g., 'Rhizogonium' read as 'Bhizogonium' and 'Jolliffe' read as 'Jollitfe'. In addition, in the case of species entries for which there must have been many specimens to hand, neither collectors nor localities are individually named. For example, for *Hypnum aciculare* [= *Ptychomnion aciculare*] the relevant information reads 'In all the islands; very common about the roots of trees in the woods.' (Hooker 1854: 110).

We have not attempted to trace records from herbarium databases of specimens. In many cases, as for example in the Natural History Museum (BM) in London the historic collections, unless recognised as type specimens, have not yet been entered into collection databases (Len Ellis pers. comm. 2021), and New Zealand specimens are often labelled merely 'N. Zd.', lacking any more precise locality.

Current names were accessed from information on changes in bryophyte names in Ngā Tipu o Aotearoa – New Zealand Plants (Allan Herbarium 2000).

RESULTS AND DISCUSSION

Structure of The Album

The Album (Fig. 1) is a small volume, with cover dimensions of 14 cm × 11.5 cm. Nevertheless, it contains 120 pages, giving a spine thickness of 10 cm. Features of its structure have been determined as follows: it is professionally produced with marbled end papers; the paper is machine-made; the cover is cow skin leather; The Album was bound first (recessed cord binding) and the specimens added later; binding indicates a date of mid to late 19th century (David Ashman pers. comm. 2021). Numerous pages bear the imprint of De la Rue printery, which was established in London in 1821 (De La Rue 2021). No tape or stitching is evident, and it is assumed that the attached specimens are glued, perhaps with 'strong gum mixed with flour-paste' as recommended by

William Hooker to one of his British collectors, Edward Hobson, for moss exsiccatae (Secord 2019).

Contents of The Album

In almost all cases a single species of a pressed plant appears on each page (e.g., Figs 2–9). Localities (Tables 1, 2; Fig. 10) are given on all but two pages.

Latin binomials, or genus only, are provided as original identifications on 78 pages (Tables 1, 2). Apart from 'New Zealand Mosses' on the front cover, there is no other printed wording, including no title page.

In spite of The Album's cover title, the 120 plant specimens (Tables 1, 2) are not all mosses. There are 81 mosses, and 36 other bryophytes, namely 35 liverworts and one hornwort. In addition, there are two seaweed specimens and one dicotyledonous vascular plant. The seaweeds, both red algae, are species of *Plocamium* and *Polysiphonia* respectively (Wendy Nelson pers. comm. 2021). The flowering plant is *Scleranthus biflorus* (J.R.Forst. et G.Forst.) Hook.f. (Ewen Cameron pers. comm. 2021), a low growing perennial in the Caryophyllaceae, which even today is described as a 'moss-like' plant (Naturally Native NZ Plants 2022). Specimens on 113 pages could be identified to species level (albeit three tentatively), and the remaining seven to genus level. Fifty-one plant families are represented; most frequently for mosses the Lembophyllaceae and Brachytheciaceae with seven and six specimens respectively, and for liverworts the Marchantiaceae and Plagiochilaceae each with four specimens. Specimens have not been mounted in any taxonomic order.

For only six mosses and two liverworts are the names given in The Album still appropriate. Most moss names and nearly half of the liverwort names used, while correct at the time (or with minor spelling errors), have been superseded; 14 mosses and three liverworts are, however, judged to be misidentified.

All bryophytes in The Album are known members of the current New Zealand flora, as listed by Gibb *et al.* (2021) and are regarded as native (indigenous). None is listed as threatened in the Department of Conservation's New Zealand Threat Classification System (de Lange *et al.* 2020; Rolfe *et al*. 2016).

A striking feature of The Album is the quality of the specimens. This is particularly evident in some liverworts which have their delicate and short-lived fruiting structures intact, e.g., *Trichocolea rigida* #021, *Schistochila appendiculata* #049, *Lepidolaena clavigera* #058 and *Pallavacinia tenuinervis* #088.

Date of assembly of The Album

Publication dates (Table 2) of the bryophyte names used in the original identifications were ascertained from the literature. These provide an earliest limit, and probable latest limit for the date of production of The Album.

For liverworts, the earliest publication date is 1753 (Linnaeus, *Species Plantarum*) for *Anthoceros punctatus* and *Jungermannia*. The latest is 1854 in W. Mitten's account for the liverworts (*Hepaticae*) in *Botany of the Antarctic Voyage, Part II Flora Novae-Zelandiae* (Hooker, 1854) for *Lepidozia spinosissima*.

From the liverwort names we are therefore able to place production of The Album as post 1854.

From the moss names a probable window for production can be ascertained. Ten different works, all European, provide the initial publication date of the names used in The Album. The earliest date is 1801 (Hedwig, *Species Muscorum Frondosorum*), for *Fumaria* [*Funaria*] *hygrometrica*, *Hypnum smithianum* [*smithii*], *Hypnum spiniforme*, *Hypnum distichum*, *Polytrichum commune*, *Hypnum aciculare*, *Weissia controversa*, and *Leskea filiculaeforme* [*filiculaeformis*]. The latest publication date is again 1854, in W.M. Wilson's account for the mosses in *Flora Novae-Zelandiae* (Hooker 1854). Moss names used in The Album that were first published in that work are *Catharomnion ciliatum*, *Fissidens ligulatus*, *Homalia falcifolia* (as *Omalia falcifolia*), *Hookeria nigella, Hypnum furfurosum*, *H. patale and H. remotifolium*. Thirteen years later Hooker's *Handbook of the New Zealand Flora* (Hooker 1867) was published, becoming the definitive work regarding New Zealand plants. In many cases, names had changed owing to taxonomic or nomenclatural progress between the 1854 and 1867 publications. None of the 1867 revised names was used in The Album. Examples include *Cyathophorum pennatum* (*Hookeria pennata* in The Album), *Hypnum chrysogaster (Hypnum patale* in The Album), *Hypopterygium filiculaeforme* (*Leskea filiculaeforme* in The Album), and *Tortula calycina* (*Tortula flexuosa* in The Album).

In summary, Hooker (1854) is the latest publication source for any of the names used in The Album (Table 2). In addition, that work contains descriptions of all species in The Album that are correctly named. Either the identifier/s of the specimens in The Album did not have access to Hooker (1867) or had named the specimens prior to that date.

On nomenclatural grounds we therefore place the production of The Album as likely to be between 1854 and 1867. This corresponds well with, and gives more precision to, the auction catalogue date of 'mid nineteenth century', and the deduction from the nature of the binding as 'mid to late 19th C.'.

Collection localities

Localities are given for 118 specimens (Tables 1, 2; Fig. 10). These are not necessarily in modern spelling, but all are identifiable, as follows: Waiheki Island [Waiheke Island], Kiri-kiri falls [Kerikeri Falls], Wangaroa and Wangeroa [Whangaroa], Parakaraka Bay of Islands [Pakaraka] and Murcury Bay [Mercury Bay]. Localities are predominantly in the north of the North Island, with only one, 'Pelorus', from the South Island. No localities are given for the two seaweeds, but today they are found on rocky substrates and are fully marine (Wendy Nelson pers. comm. 2021). Although localities given are mostly imprecise, all are compatible with collection having taken place using sea transport, with short excursions inland, viz., to Kerikeri Falls, Waitangi Falls and Pakaraka. There is no geographic order in the pages of The Album.

Table 1. Statistics for The Album.

	Mosses	Liverworts	Hornworts	Seaweeds	Flowering plants	Total
Pages	81	35	1	2	1	120
Pages with localities	81	35	1	–	1	118
Pages with taxon identification	59	18	1	–	–	78
Extant name used	6	2	–	–	–	8
Earlier name used	39	13	–	–	–	52
Misidentifications	14	3	1	–	–	18
With structures related to sexual reproduction	57 with sporophytes	32 with perianths or coelocaules	1 with sporophyte	1 with cystocarps	–	90

Specimen selection

Almost all the plant specimens are species of moderate to large stature, or with conspicuous fruiting structures at the time of their collection. In the genus *Fissidens* for example, only two species have been collected, *F. rigidulus* and *F. asplenioides*, which are the largest of the common species in the genus. It is apparent that a real effort was made to collect fertile specimens, as 57 of the 81 mosses, 32 of the 35 liverworts and the single hornwort bear sexual reproductive structures (Table 1). Of the liverworts that do not, *Chandonanthus squarrosus* (#028) and *Dendromastigophora flagellifera* (#053) are especially large and striking species. Two pages have a fragment of a second species included: *Megaceros* ?*leptohymenius* (#029) has a fragment of *Heteroscyphus allodontus*, and *Lepidolaena clavigera* (#058) has a fragment of a species of *Radula*. These small fragments of plants are most likely to have been collected with the *Megaceros* and *Lepidolaena*, but, as nothing is known of the collecting techniques adopted, it is not possible to conclude that these were *in situ* in the field together, rather than being examples of later contamination.

In addition to these two pages with included fragments, there is one mixed page (#038) with robust shoots of two very similar mosses given equal prominence, namely *Thuidiopsis furfurosa* and *Thuidium laeviusculum*. Here two species names (in genus *Hypnum*), have been applied, 'remotifolium' and 'purpurosum', bracketed and queried. *Hypnum remotifolium* had been recorded by Hooker (1854: 357) for New Zealand, although the presence of the species in New Zealand is now doubted (Fife 2020) and Hooker's records are likely misapplied. Regardless, that moss is in a different family, the Brachytheciaceae, and most unlikely to be mistaken for a *Thuidium* or a *Thuidiopsis*. We have been unable to trace any moss epithet 'purpurosum', and the script used for 'f' elsewhere in The Album (e.g., *Hypnum bifarium* #008) does not resemble the 'p' in 'purpurosum'. Notwithstanding these complications, we assume that the specimen has been in part correctly annotated as *Hypnum furfurosum*, and the presence of two taxa was not recognized.

There is some duplication in The Album, with nine moss species and three liverwort species appearing on two pages.

All the bryophytes are common species in New Zealand today. They are found in a variety of lowland habitats, especially in forest but also in scrub, swamps, and streams, or on open ground. Species may be epiphytic or terrestrial on soil or rock.

Contemporary fern albums and the existence of British moss albums

The similarity of The Album to those produced in the well-documented Victorian craze for albums of ferns deserves comment. As Hayward and Rickard (2019: 1) note in their lavishly illustrated book *Fern Albums and Related Material*, 'travellers and emigrants to the far reaches of the British Empire arrived to find an exciting range of new flowering plants and ferns to gather for their personal collections and to send home to relatives. This was particularly so in New Zealand, where a small industry developed producing fern albums for sale.' Albums were made 'by a local stationer or selected from an increasing range of scrap albums and collecting albums that were being produced in large numbers.'

Bryophytes, being a much less conspicuous element of the vegetation, less well known, and less attractive as pressed specimens, at least to the general public, did not experience a similar surge in interest. Mosses were sometimes given a decorative role in fern albums. Goulding (1977), in her study of New Zealand fern albums, notes that typically the mounted fronds 'sprang from a base of bright green [dyed] mosses … added as

decoration.' The scientific plant name is usually given for ferns, but 'no names are given for the lowly mosses'. An example is shown in Fig. 3.28d of Hayward & Rickard (2019: 83), where the frond base of *Hymenophyllum scabrum* is decorated with pinnae of other ferns and shoots of a pleurocarpous moss.

Albums of mosses in their own right are much less common. We are aware of some albums of named British mosses (see, for example, Godfrey 2010; Hayward & Rickard 2019). The best-known British creators of moss albums (and to a much greater extent, of fern albums) are Joseph Flintoft (1796–1860) and his son Joseph James Flintoft (1826–1877), who produced albums from about 1850 onwards. Of the Flintoft moss albums, only one is known with a dated title page, namely 1858 (Hayward & Rickard 2019: 40). The covers of two Flintoft moss albums and the dated title page are illustrated as Fig. 2.31 (Hayward & Rickard 2019: 41).

As is the case for ferns, collections of loose-leaf exsiccatae of mosses were also produced in Britain. An example is described in detail by Hayward & Rickard (2019: 32), and its front cover illustrated in their Fig. 2.22a. A gilt embossed title *Mosses of Derbyshire collected by John Tym* on the cover is not dissimilar to that of The Album's *New Zealand Mosses.* John Tym (1829–1910) advertised such portfolios for sale, the earliest dated found being 1851. Of those seen by Hayward & Rickard (2019), although generally titled *Mosses of Derbyshire*, most also contained ferns and lycopods. In these portfolios scientific names on printed labels were attached to the sheets, including those for mosses. The concept of such exsiccatae persists to the present day, whereby fully labelled sets of loose-leaf mounted specimens are distributed and intended to be used as reliably identified reference collections (Malcolm & Malcolm 2006). Clearly, The Album is not in this category.

Early bryological exploration of New Zealand

The earliest Northern Hemisphere collectors of mosses in New Zealand, those whose specimens made their way into the first published annals of this country's bryology, are likely to have been the naturalists on James Cook's voyages to New Zealand between 1769 and 1777. Johannes Hedwig's *Species Muscorum Frondosorum,* published in 1801, included the description of two moss species, *Bryum dichotomum, Leskea [Weymouthia] mollis* and possibly also a third, *Hypnum [Rhaphidorrhynchium] amoenum*, from New Zealand but with collectors unknown (Fife 1985). Joseph Banks and Daniel Solander, naturalists on the *Endeavour* with James Cook on his First Voyage to New Zealand collected mosses in the vicinity of Ship Cove, Marlborough Sounds, as an excerpt from Banks' journal for 25 January 1770 (Beaglehole 1962: 459) indicates:

> 25. D^{r} Solander and myself (who have now nearly exhausted all the Plants in our neighbourhood) went today to search for Mosses[1] and small things, in which we had great success gathering several very remarkable ones.

With editor's footnote:

> [1]The MS "Catalogue of the plants of Cook's First Voyage in the order in which they were loosely placed in the drying books in which they were brought home" lists 33 bryophytes for Tierra del Fuego but none for New Zealand.

Despite the apparent lack of extant specimens, at least some of the New Zealand moss collections from this voyage are now in the herbarium of the Natural History Museum, London (BM). Some were studied and named by Ernst Ludwig Heim (1747–1834) pre-Hedwig, but others are likely scattered undatabased throughout the general BM moss collections – their existence not yet noted (Len Ellis pers. comm. 2019).

While the senior author was examining New Zealand mosses in BM in 2008, one of these came to light, a specimen of *Weissia controversa* Hedw., lacking modern identification and labelled 'Nova Zelandia J.B.'. The handwriting and the water-mark of the sheet enabled Curator of Bryophytes, Len Ellis, to confirm that 'J.B.' was indeed Joseph Banks, adding another early record to New Zealand's bryophyte flora.

A well-documented collection of New Zealand mosses and liverworts was later made by Archibald Menzies, surgeon on the Vancouver Expedition, during a three-week stay in 1791, at Dusky Sound in Fiordland (Fife 1985). J.D. Hooker in his Preface to the *Handbook of the New Zealand Flora* (Hooker 1867: 9) described Menzies as 'a very assiduous collector of Flowerless plants, who procured many species of ... *Musci*, and *Hepaticae*, most of which are described at length, and beautifully illustrated in [William] Hooker's *Musci Exotici*.'

William Jackson Hooker and his son, Joseph Dalton Hooker were successive directors of the Royal Botanic Gardens Kew, spanning the years 1841 to 1885 in that position. Together with specialists William Wilson (mosses) and William Mitten (hepatics, i.e., liverworts) they became the foremost authorities on New Zealand bryophytes (Engel & Glenny 2008; Fife 1985), with their work published in Hooker (1854) and Hooker (1867).

The following botanists were all active 19th century collectors of bryophytes in New Zealand: Daniel Bolton, William Colenso, Joseph D. Hooker, Charles Knight, John Jolliffe, Francis Logan, David Lyall, Augustus Oldfield, Etienne Raoul and Andrew Sinclair. Specimens were shipped back to England (or to Paris in the case of those of Etienne Raoul) where they were studied, described and illustrated. Most of them remain in northern hemisphere herbaria today, although some are found in New Zealand herbaria, notably WELT (Te Papa Tongarewa) and AK (Auckland War Memorial Museum).

As The Album is a previously unknown addition to extant collections from early bryological activity in New Zealand, it is worth researching who its collector/s, assembler/s and identifier/s might have been.

Table 2. Plant identifications and collection localities.

Image number	Original Identification	Locality [1]	Modern Identification [2]	Plant group	Family	Date [3]
#006	Sphagnum	Pelorus	*Sphagnum cristatum*	moss	Sphagnaceae	
#007		Pelorus	*Lepidolaena taylorii*	liverwort	Lepidolaenaceae	
#008	Hypnum bifarium	Waiheki Island. N.Z.	*Pyrrhobryum bifarium*	moss	Rhizogoniaceae	1818
#009	Hookeria pennata	Auckland. N.Z.	*Cyathophorum bulbosum*	moss	Hypopterygiaceae	1808
#010	Dicranum, candidum	Hokianga River. N.Z.	*Leucobryum javense*	moss	Leucobryaceae	1805
#011	Neckera setosa	Hokianga River. N.Z.	*Cyrtopus setosus*	moss	Cyrtopodaceae	1818
#012	Dicranum. Menziesii	Manukau Harbour N.Z.	*Dicranoloma fasciatum*	moss	Dicranaceae	1844
#013	Hypnum smithianum	Hokianga River. N.Z.	*Hypopterygium didictyon*	moss	Hypopterygiaceae	NA
#014	Hypnum hispidum.	Auckland. N.Z.	*Echinodium hispidum*	moss	Echinodiaceae	1844
#015	Campylopus	Bay of Plenty. N.Z.	*Campylopus clavatus*	moss	Dicranaceae	
#016	Phyllogonium elegans	Manukau Harbour N.Z.	*Orthorrhynchium elegans*	moss	Orthorrhynchiaceae	1844
#017		Waiheki Island N.Z.	*Schistochila balfouriana*	liverwort	Schistochilaceae	
#018	Plagiochila Gigantea	Waiheki Island. N.Z.	*Plagiochila trispicata*	liverwort	Plagiochilaceae	1840
#019	Trichocolea tomentella	Coromandel. N.Z.	*Trichocolea rigida*	liverwort	Trichocoleaceae	1831
#020	Dicranum Billiardeiri?	Coromandel. N.Z.	*Dicranoloma billardierei*	moss	Dicranaceae	1802
#021	Trichocolea tomentella	Coromandel. N.Z.	*Trichocolea rigida*	liverwort	Trichocoleaceae	1831
#022		Waiheki Island. N.Z.	*Plagiochila colensoi*	liverwort	Plagiochilaceae	
#023	Trichocolea lanata	Coromandel. N.Z.	*Leiomitra lanata*	liverwort	Trichocoleaceae	1838
#024		Manukau Harbour. N.Z.	*Rhynchostegium muriculatum*	moss	Brachytheciaceae	

1 Original spelling of localities.
2 Modern names follow Gibb *et al.* (2020) for mosses, liverworts, and hornworts.
3 Date of publication of name used in The Album.

Image number [4]	Original Identification	Locality [1]	Modern Identification [2]	Plant group	Family	Date [3]
#025		Kiri-kiri falls. Bay of Islands. N.Z.	*Lepidolaena taylorii*	liverwort	Lepidolaenaceae	
#026	Tortula. flexuosa	Coromandel. N.Z.	*Barbula calycina*	moss	Pottiaceae	1819
#027		Waiheki Island. N.Z.	*Lobatiriccardia* sp.	liverwort	Aneuraceae	
#028		Pelorus	*Chandonanthus squarrosus*	liverwort	Anastrophyllaceae	
#029	Anthoceros punctatus	Hokianga River. N.Z.	*Megaceros ? leptohymenius*	hornwort	Dendrocerotaceae	1753
#030		Waiheki Island. N.Z.	*Bazzania tayloriana*	liverwort	Lepidoziaceae	
#031		Pelorus	*Lembophyllum clandestinum*	moss	Lembophyllaceae	
#032	Hypnum ?penpusosum/ ?remotifolium	Murcury Bay. N.Z.	*Thuidiopsis furfurosa*	moss	Thuidiaceae	1854
#033		Pelorus	*Weymouthia mollis*	moss	Lembophyllaceae	
#034	Bartramia tormentosa	Kiri-kiri falls. Bay of Islands. N.Z.	*Breutelia pendula*	moss	Bartramiaceae	1817
#035		Pelorus	*Acrocladium chlamydophyllum*	moss	Lembophyllaceae	
#036		Waiheki Island.	*Polytrichadelphus magellanicus*	moss	Polytrichaceae	
#037	Hookeria rotundifolia	Wangaroa. N.Z.	*Distichophyllum crispulum*	moss	Daltoniaceae	1844
#038	Hypnum ?purpurosum/?remotifolium	Hokianga River. N.Z.	*Thuidium laeviusculum* & *Thuidiopsis furfurosa*	moss	Thuidiaceae	1854
#039	Hypnum spiniforme	Wangaroa. N.Z.	*Rhizogonium novae-hollandiae*	moss	Rhizogoniaceae	1801
#040	Leskia ericoides	Pelorus.	*Cladomnion ericoides*	moss	Ptychomniaceae	1818
#041		Auckland. N.Z.	*Rhynchostegium tenuifolium*	moss	Brachytheciaceae	
#042	Polytrichum commune.	Hokianga River. N.Z.	*Polytrichum commune*	moss	Polytrichaceae	1801
#043	Fumaria[5] hygrometrica	Hokianga River. N.Z.	*Funaria hygrometrica*	moss	Funariaceae	1801

4 See Appendix for link to image of each page in the album. Identified by image number.

5 Generic name likely a trivial confusion between the flowering plant name ‘Fumaria’ and the moss name ‘Funaria’, and is scored as an extant name.

Image number [4]	Original Identification	Locality [1]	Modern Identification [2]	Plant group	Family	Date [3]
#044	Hookeria nigella	Wangaroa. N.Z.	*Achrophyllum dentatum*	moss	Daltoniaceae	1854
#045		Waiheki Island. N.Z.	*Bazzania adnexa* var. *adnexa*	liverwort	Lepidoziaceae	
#046	Hypnum cochlearifolium	Pelorus	*Weymouthia cochlearifolia*	moss	Lembophyllaceae	1816
#047		Hick's Bay. N.Z.	*Echinodium hispidum*	moss	Echinodiaceae	
#048	Hypnum distichum or Rhizogonium	Pelorus	*Rhizogonium distichum*	moss	Rhizogoniaceae	1801
#049	Gottschea appendiculata	Waiheki Island. N.Z.	*Schistochila appendiculata*	liverwort	Schistochilaceae	1844
#050		Pelorus	*Wijkia extenuata*	moss	Sematophyllaceae	
#051	Racomitrium Spectabile	Hokianga River. N.Z.	*Racopilum strumiferum*	moss	Racopilaceae	NA
#052	Hypnum menziesii	Hokianga River. N.Z.	*Sciadocladus menziesii*	moss	Pterobryellaceae	1818
#053	Sendtnera scolopendra.	Coromandel. N.Z.	*Dendromastigophora flagellifera*	liverwort	Mastigophoraceae	1845
#054	Hypnum (spininervium?)	Manukau Harbour. N.Z.	*Hypnodendron arcuatum*	moss	Hypnodendraceae	1818
#055	Hypnum aciculare	Coromandel. N.Z.	*Ptychomnion aciculare*	moss	Ptychomniaceae	1801
#056		Parakaraka Bay of Islands	*Pogonatum subulatum*	moss	Polytrichaceae	
#057		Wangaroa. N.Z.	*Plagiochila banksiana* var. *banksiana*	liverwort	Plagiochilaceae	
#058	Jungermannia	Waitangi Falls. Bay of Islands.	*Lepidolaena clavigera*	liverwort	Lepidolaenaceae	1753
#059	Weissia controversa	Wangaroa. N.Z.	*Weissia* sp. (not *W. controversa*)	moss	Pottiaceae	1801
#060	Hypnum furfurosum	Waitangi Falls. Bay of Islands.	*Thuidiopsis furfurosa*	moss	Thuidiaceae	1854
#061	Hypnum Arbuscula	Hokianga River. N.Z.	*Camptochaete deflexa*	moss	Lembophyllaceae	1819
#062		Waitangi Falls. Bay of Islands.	*Tayloria octoblepharum*	moss	Splachnaceae	
#063		Hokianga River. N.Z.	*Hymenodon pilifer*	moss	Orthodontiaceae	
#064	Hypnum spinener[?]ium?	Wangaroa. N.Z.	*Camptochaete deflexa*	moss	Lembophyllaceae	1818

Image number [4]	Original Identification	Locality [1]	Modern Identification [2]	Plant group	Family	Date [3]
#065	Funaria. (in pencil: "(calvescens)"	Auckland. N.Z.	*Bryum* sp.	moss	Bryaceae	1801
#066	Hypnum cochlearifolium	Hokianga River. N.Z.	*Weymouthia cochlearifolia*	moss	Lembophyllaceae	1816
#067		Waiheki Island. N.Z.	*Heteroscyphus coalitus* var. *coalitus*	liverwort	Lophocoleaceae	
#068	Hookeria quadrifaria	Waiheki Island. N.Z.	*Achrophyllum quadrifarium*	moss	Daltoniaceae	1808
#069	Dicranum (setosum?)	Manukau Harbour N.Z.	*Dicranoloma menziesii*	moss	Dicranaceae	1844
#070	Bryum	Wangaroa. N.Z.	*Rosulabryum subtomentosum*	moss	Bryaceae	
#071	Funaria.	Coromandel. N.Z.	*Entosthoson subnudus* var. *gracilis*	moss	Funariaceae	
#072		Wangaroa. N.Z.	? *Platyhypnidium austrinum*	moss	Brachytheciaceae	
#073	Hypnum comosum	Kiri-kiri falls. Bay of Islands. N.Z.	*Mniodendron comatum*	moss	Hypnodendraceae	1807
#074	Hypnum leptorynchum.	Wangaroa. N.Z.	*Ctenidium pubescens*	moss	Hypnaceae	
#075		Wangaroa. N.Z.	*Sematophyllum jolliffii*	moss	Sematophyllaceae	
#076	Lepidozia spinosissima	Pelorus	*Lepidozia spinosissima*	liverwort	Lepidoziaceae	1854
#077	Hypnum leptorynchum, var.?	Wangaroa. N.Z.	*Hypnum chrysogaster*	moss	Hypnaceae	NA
#078	Hypnum marginatum	Pelorus	*Hypnodendron marginatum*	moss	Hypnodendraceae	1844
#079	Leskea filiculaeforme	Manukau Harbour. N.Z.	*Dendrohypopterygium filiculiforme*	moss	Hypopterygiaceae	1801
#080	Hypnum	Coromandel.	*Pyrrhobryum paramattense*	moss	Rhizogoniaceae	
#081	Leskea concinna	Hokianga River. N.Z.	*Lopidium concinnum*	moss	Hypopterygiaceae	1818
#082		Pelorus	*Riccardia filicina*	liverwort	Aneuraceae	
#083		Poverty Bay. N.Z.	*Scleranthus biflorus*	flowering plant	Caryophyllaceae	
#084		Waiheki Island. N.Z.	*Plagiochila intertexta*	liverwort	Plagiochilaceae	

Image number	Original Identification	Locality [1]	Modern Identification [2]	Plant group	Family	Date [3]
#085		Wangaroa. N.Z.	*Pendulothecium auriculatum*	moss	Neckeraceae	
#086		Auckland. N.Z.	*Metzgeria furcata*	liverwort	Metzgeriaceae	
#087	Madotheca stangeri	Coromandel. N.Z.	*Porella elegantula*	liverwort	Porellaceae	1845
#088		Auckland. N.Z.	*Pallavacinia tenuinervis*	liverwort	Pallaviciniaceae	
#089	Symphogyna Hymenophyllum	Waiheki Island. N.Z.	*Symphyogyna hymenophyllum*	liverwort	Pallaviciniaceae	1836
#090	Jungermannia Phyllanthus	Waikato River. N.Z.	*Symphyogyna subsimplex*	liverwort	Pallaviciniaceae	1818
#091	Bartramia radicalis. tenuis.	Wangaroa. N.Z.	*Philonotis tenuis*	moss	Bartramiaceae	1805
#092	Lencodon [Leucodon] bartramodes	Pelorus	*Cryptopodium bartramioides*	moss	Rhizogoniaceae	1818
#093		Hick's Bay. N.Z.	*Brachythecium ?plumosum*	moss	Brachytheciaceae	
#094		Pelorus	*Distichophyllum crispulum*	moss	Daltoniaceae	
#095	Dicranum.	Pelorus.	*Dicranoloma dicarpum*	moss	Dicranaceae	
#096	Polytrichum commune	Pelorus	*Polytrichum commune*	moss	Polytrichaceae	1801
#097		Coromandel.	*Wijkia extenuata*	moss	Sematophyllaceae	
#098	Marchantia	Wangaroa. N.Z.	*Asterella tenera*	liverwort	Aytoniaceae	
#099	Marchantia.	Hick's Bay. N.Z.	*Marchantia pileata*	liverwort	Marchantiaceae	
#100	Omalia falcifolia	Wangaroa. N.Z.	*Pseudotaxiphyllum falcifolium*	moss	Hypnaceae	1854
#101		Wangaroa. N.Z.	*Rhaphidorryhnchium amoenum*	moss	Sematophyllaceae	
#102	Marchantia	Bay of Plenty. N.Z.	*Asterella australis*	liverwort	Aytoniaceae	
#103	Marchantia	Hokianga River. N.Z.	*Marchantia berteroana*	liverwort	Marchantiaceae	
#104		Waiheki Island. N.Z.	*Spruceanthus olivaceus.*	liverwort	Lejeuneaceae	

Image number [4]	Original Identification	Locality [1]	Modern Identification [2]	Plant group	Family	Date [3]
#105	Marchantia.	Poverty Bay.	*Asterella australis*	liverwort	Aytoniaceae	
#106	Marchantia.	Hokianga River. N.Z.	*Marchantia foliacea*	liverwort	Marchantiaceae	
#107	Marchantia.	Bay of Plenty. N.Z.	*Marchantia berteroana*	liverwort	Marchantiaceae	
#108	Funaria?	Wangaroa. N.Z.	*Bryum* sp.	moss	Bryaceae	
#109		Hick's Bay. N.Z.	*Leptodictyum riparium*	moss	Amblystegiaceae	
#110	Trichosmum setosum	Auckland. N.Z.	*Ditrichum difficile*	moss	Ditrichaceae	1842
#111		Hick's Bay. N.Z.	*Leptoscyphus compactus*	liverwort	Lophocoleaceae	
#112		Waiheki Island. N.Z.	*Heteroscyphus allodontus*	liverwort	Lophocoleaceae	
#113		Hick's Bay. N.Z.	*Fissidens rigidulus* var. *rigidulus*	moss	Fissidentaceae	
#114		Hick's Bay. N.Z.	*Tridontium tasmanicum*	moss	Pottiaceae	
#115	Hypnum patale	Wangaroa N.Z.	*Hypnum chrysogaster*	moss	Hypnaceae	1854
#116		Hick's Bay. N.Z.	*Rhynchostegium tenuifolium*	moss	Brachytheciaceae	
#117	Hypnum leptorynchum	Pelorus.	*Rhynchostegium tenuifolium*	moss	Brachytheciaceae	1812
#118	Macromitrium.	Manukau Harbour N.Z.	*Macromitrum prorepens*	moss	Orthotrichaceae	1819
#119	Catharomnion.	Wangaroa. N.Z.	*Catharomnion ciliatum*	moss	Hypopterygiaceae	1854
#120	Fissidens ligulatus.	Wangaroa. N.Z.	*Fissidens asplenioides*	moss	Fissidentaceae	1854
#121	Leptostomum macrocarpum.	Wangeroa [sic]	*Leptostomum macrocarpon*	moss	Leptostomataceae	1814
#122	Leucodon calycinus. (Hook.) Dicnemon calycinus (Brid)	Manukau Harbour. N.Z.	*Dicnemon calycinum*	moss	Dicnemonaceae	1818, 1824
#123	Catharomnion ciliatum.	Wangaroa. N.Z.	*Catharomnion ciliatum*	moss	Hypopterygiaceae	1854
#124			*Plocamium* sp.	red seaweed	Plocamiaceae	
#125			*Polysiphonia* s.l.	red seaweed	Rhodomelaceae	
#126	empty page					

Figure 2. *Lepidolaena clavigera*, a delicate liverwort, retaining very fragile sporophytes.

Figure 3. *Lepidozia spinosissima*, a large, finely dissected liverwort, bearing remnant perianths.

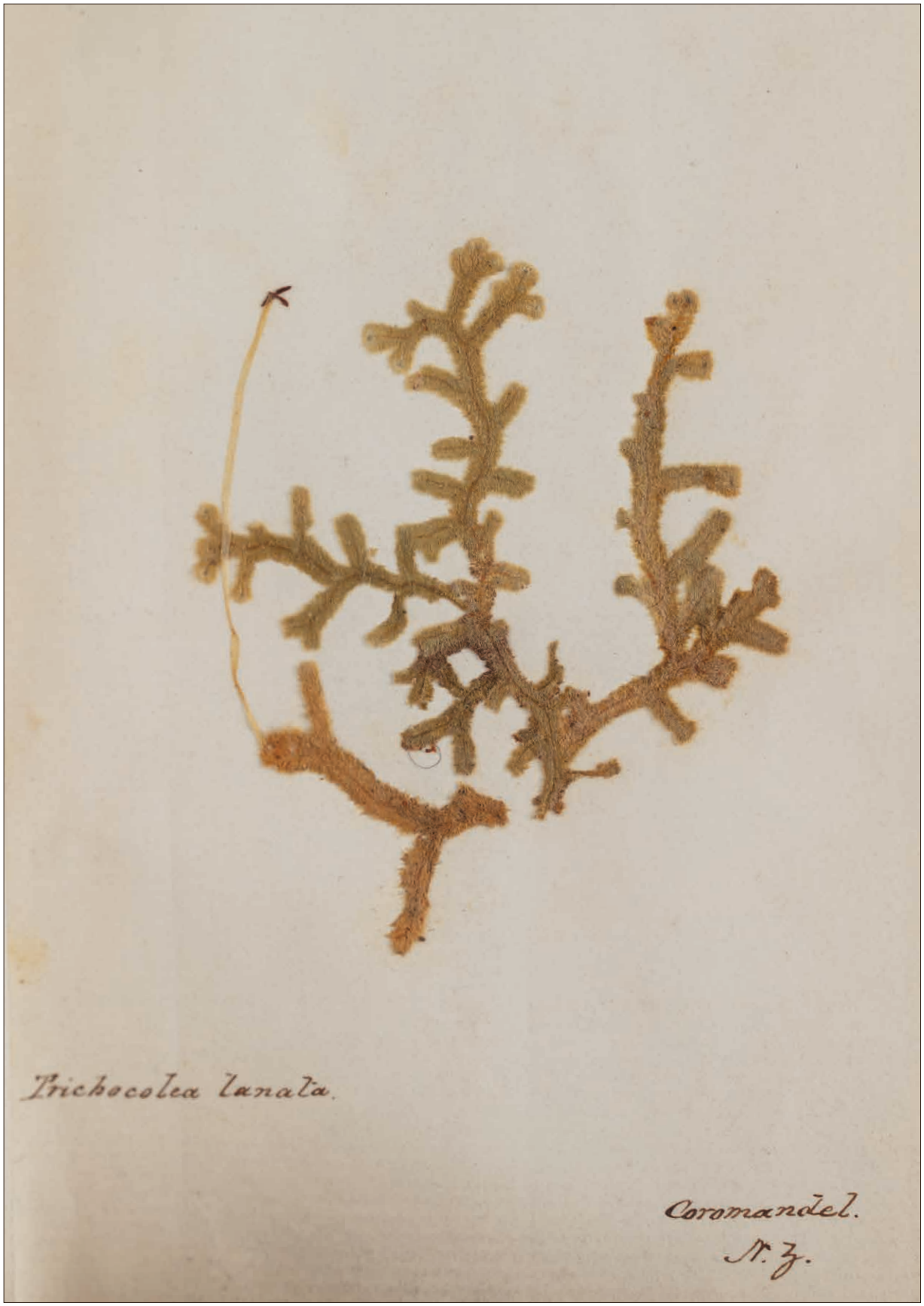

Figure 4. *Leiomitra lanata*, a distinctive liverwort, like fingers of green velvet, endemic to New Zealand and found throughout, with sporophyte. © Auckland Museum CC BY. [#023]

Figure 5. *Schistochila appendiculata*, one of the largest leafy liverworts, with sporophytes.

Figure 6. *Sphagnum cristatum*, a common moss in swamps, with capsules. © Auckland Museum CC BY. [#006]

Figure 7. *Mniodendron comatum*, an umbrella moss, with capsules. © Auckland Museum CC BY. [#073]

Figure 8. *Dendrohypopterygium filiculiforme*, an umbrella moss, with capsule. © Auckland Museum CC BY. [#079]

Figure 9. *Thuidiopsis furfurosa* (central plant), with capsules and *Thuidium laeviusculum* (lateral plants).

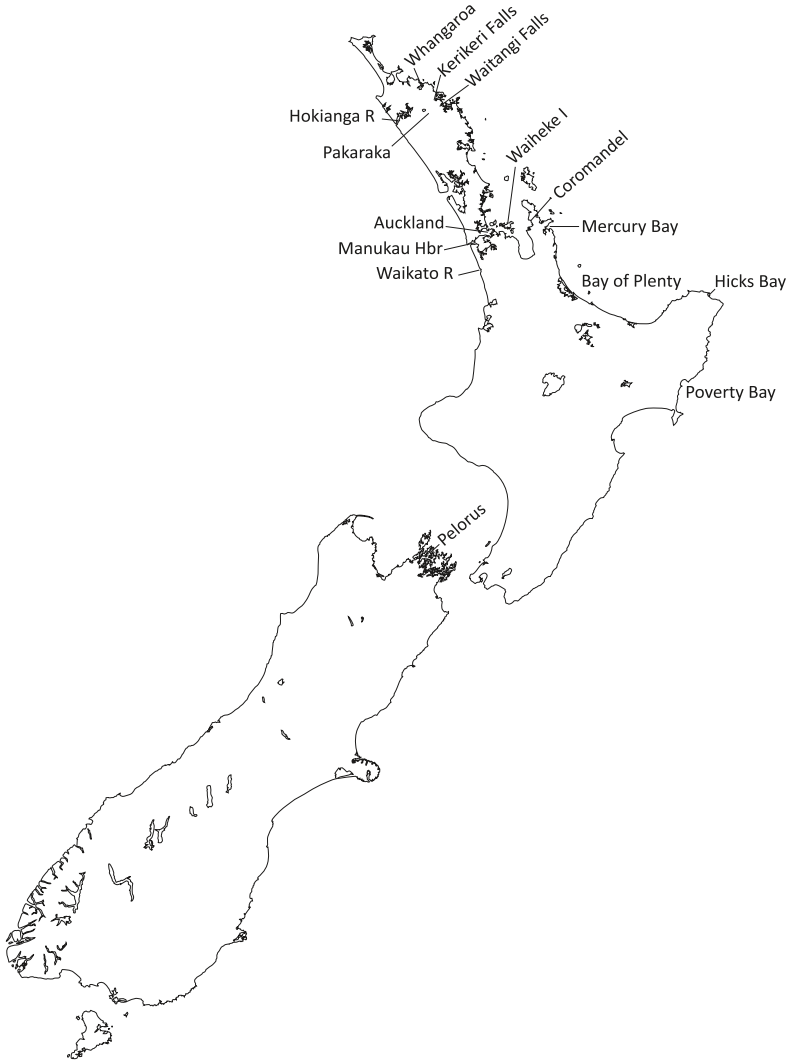

Figure 10. Map of New Zealand showing collection localities (with modern spelling).

Possible collectors for The Album

It is a striking feature of The Album that all bryophyte localities are easily accessible from the coast (Fig. 10), with indications of approach being from the sea, e.g., 'Hokianga R', 'Manukau Hbr' and 'Waikato R'. All are from the northern North Island, with the notable exception of 'Pelorus', located in the Marlborough Sounds at the north of the South Island. Bearing this in mind, some speculation is possible on who may have collected the specimens in The Album.

Of active bryophyte collectors of the relevant period, those who were resident in New Zealand and had numerous opportunities to collect inland are less likely to be candidates for the role of The Album's coastal collector. Into that category fall Daniel Bolton (Godley 2003), William Colenso (St George 2009), Charles Knight (Galloway 2013), Francis Logan (Godley 1999) and Andrew Sinclair (Molloy 1990). Augustus Oldfield collected primarily in Australia (CHAH 2022), with only two specific New Zealand moss localities cited by J.D. Hooker in his two great New Zealand botanical treatises (1854; 1867), namely Bay of Islands and Port Cooper [Lyttelton]. E.F.L. Raoul has 12 bryophyte specimens cited by Hooker (1854; 1867), all from Akaroa. Occasional individual collections cited by Hooker (1854; 1867) match those in The Album, e.g., Sinclair collected *Hypnum bifarium* at 'Waikehi' (Hooker 1854: 96), and the same species was collected as #008 with locality 'Waiheki' in The Album, but no overall pattern of comparability has been found with the above collectors.

Two other plant collectors were ship-board travellers — the surgeons Dr David Lyall and Dr John Jolliffe on the ships *Acheron* and *Pandora* respectively, during the Great Survey of New Zealand (1848–1855), the first systematic and detailed maritime survey of the entire coastline and harbours of New Zealand (Byrne 2007; Maling 1999; McKinnon *et al*. 1997).

Admiralty policy at the time was to encourage 'the collection of information upon scientific subjects by the officers, and more particularly by the medical officers when upon foreign service' (Byrne 2007: 76). Both Lyall and Jolliffe were avid collectors, in accordance with Admiralty policy, and no doubt also with their own inclinations. Many bryophyte specimens were shipped back to Kew, becoming voucher specimens for study by Mitten, Wilson and Hooker (Hooker 1854, 1867). In his preface to the *Handbook of the New Zealand Flora*, Hooker (1867: 11) acknowledges 'Captain Stokes, R.N. in H.M.S. Acheron, [who] surveyed the coast of New Zealand …' and who 'was accompanied by Dr. Lyall, who made very large and excellent collections, especially of Flowerless plants [which include bryophytes], on various parts of the coast, but chiefly of the Middle [South] Island.' Hooker (1867: 11) also acknowledges 'Capt. Drury R.N., [and] Mr. Jolliffe, who contributed interesting and important collections which are embodied in the 'Flora Novae-Zelandiae'.' There is a handsome certificate, reproduced by Byrne (2007: 264), acknowledging the contribution of 'An interesting collection of Botanical Specimens for the Museum, collected by Mr Jolliffe from Commander Drury, collected in New Zealand.' and signed 'W.J. Hooker, Director, Royal Gardens Kew, July 2. 1853.'

We have focussed attention on the itineraries of these two ships, and the evidence provided by specimen collections from their surgeons.

The survey work was begun by the *Acheron* (1848–1851), a steam-powered paddle-wheeler of 722 tons, under the command of Captain (later Admiral) John Lort Stokes. Greatly to the disappointment of Captain Stokes (Byrne 2007: 54), the *Acheron* was paid off at the end of 1851, and David Lyall arrived back in England in 1852 (Lyall 2010: 35). The *Acheron* was replaced by H.M.S. *Pandora*, a 319-ton brig relying on sail alone, commanded by Captain Byron Drury (Byrne 2007; Maling 1999). The completed chart for the whole of New Zealand was an amalgamation of the work of the two ships, published as Chart No. 1212 by the Hydrographic Office of the Admiralty, 3 March 1856, reproduced by both Maling (1999: 151) and Byrne (2007: xiv) and available online as a corrected version (Great Britain Hydrographic Department 1874).

Details of the portions of the *Acheron-Pandora* Survey accomplished by each ship are given in contemporary accounts; e.g., for the *Acheron*:

> Large and detailed plans have been made of the Gulf of Shouraka [Hauraki Gulf], including Waimate [Waitemata], Waikeke [Waiheke], and the River Thames [Thames Estuary], Mercury Bay, Poverty Bay, Hawke Bay, all the ports and anchorages in Cook's Straits excepting the **Pelorus River** [authors' bold], Port Cooper [Lyttelton], Akaroa, Otago, Molineux Harbour [mouth of Clutha River], on the east coast of the Middle Island [South Island]; and the numerous and deep sounds on its south-west part, viz. Preservation Harbour, Chalky Bay, Dusky Bay, Doubtful Harbour, and that most remarkable feature of the coast, Milford Haven. (Anon. 1852).

And for the *Pandora*, Captain Drury noted in his report:

> The information is, with the exception of the report upon the Pelorus, confined to the Northern Island, as my predecessor, Captain Stokes, had been engaged upon the investigation of the coast of the Middle Island [South Island], and other southern portions of the Colony. (Drury 1854: 4).

A newspaper article (Anon. 1852) describes the coastline apportioned to each of the survey ships. On the withdrawal of the *Acheron*

> all that now remain to be done, as we are informed, are the following portions of the North Island, containing about 500 miles of coast:– The north extreme, from the Bay of Islands and the west coast to Cape Egmont, at the northern entrance of Cook's Straits, and a portion of the north-east coast between Tauranga and East Cape, with the ports of Wangarooa [Whangaroa], Okiahangtea [Hokianga], and False Okiahanga [False Hokianga = Herekino], Kiapara [Kaipara], and the entrance of Port Manukao [Manukau Harbour]. Cook's Straits require a little detail on the south shore, about Pelorus River.

The combined chart of this last region (a section from Admiralty Chart 2054) is reproduced in the *New Zealand Historical Atlas* (McKinnon *et al*. 1997: Plate 35), and clearly labelled 'Cook Strait, 1849–1851, Surveyed by H.M.S.V. *Acheron*, Pelorus Sound by H.M.S. *Pandora* 1853'.

In summary, evidence has been found that the *Acheron* visited the following five localities named in The Album: Waiheke, Mercury Bay, Poverty Bay and Waitemata (as Waimate) encompassing Auckland, and with River Thames [Thames Estuary] perhaps encompassing Coromandel, but did not include Pelorus.

Jolliffe, on the *Pandora*, visited all coastal localities given in The Album, as evidenced by his Diary (Jolliffe 1851–1856a), and summaries of his Medical Notebook and Journals (Coster 1980).

In addition, while visiting the Bay of Islands in September 1853, he drew two sketches of 'Kerikeri Falls', and a year later in September 1854 a sketch of 'Waitangi Falls.' No record has yet been found of his visiting Pakaraka further inland, at that time the farm of missionary Henry Williams (Louise Furey pers. comm. 2021) and a likely source of hospitality for pākehā visiting the Bay of Islands. William Colenso, albeit a prodigious walker, mentions walking from Kororareka on the coast in the Bay of Islands to Pakaraka and back within a day (Colenso [1839]: 166).

Thus, opportunities to collect in certain localities named in The Album were available to those on board both the *Acheron* and the *Pandora*, but with a more complete coverage for those on the *Pandora*.

In addition, evidence from specimens collected by the surgeons on the *Acheron* and the *Pandora*, gives further insight into who may have collected for The Album. Bryophyte sections in Hooker (1854) and Hooker (1867) are substantial, comprising pages 57–172 and 393–549 respectively. Although certainly providing an incomplete record of their individual collections, digital searches of these pages have given further relevant information.

A search for 'Lyall' revealed 179 mentions. Among the many localities for bryophyte specimens attributed to Lyall, only Auckland also features in The Album, and the species do not match.

A similar digital search for 'Jolliffe' or 'Joliffe' revealed 30 mentions, of which five match the species and locality in The Album (Table 3). Given that these species are common and widespread in New Zealand today, with the exception of *Sematophyllum jolliffii*, the matching of five records could be coincidental.

The chronology of the *Pandora* (Byrne 2007: 272) indicates that Pelorus was visited from 28 January to 25 March 1854. During that time Jolliffe undertook two overland journeys, firstly to Nelson and secondly to the Wairau Plains (Byrne 2007: 210, 211). William Colenso, in a letter to J.D. Hooker (St. George 2009: 306–307) mentions, somewhat disparagingly, Jolliffe (as 'Joliffe') collecting plants, thus:

> Waitangi, Hawke's Bay
> N. Zealand, Feby 23/55
> My dear Dr Hooker … A number of the Nelson Examiner (Cook's Straits Paper) of Jany. 6/55, now before me, contains an account of a 'Journey from the head of the Pelorus (River) to the Wairau Plains, by Mr Blackney', having annexed a 'Summary of the remarks of Dr Joliffe on the Botany &c., of that estuary'. Both gentlemen I presume belong to H.M.S. "Pandora". The Doctor's Botanl. list seems to contain but little novelty. He says – "The nikau palm … Of Mosses, Jungermanniæ, Liverworts & Lichens more than 140 kinds were collected, the greater No. of them [also] being found in the N. Island." He also gives a list (Native names) of Trees & shrubs: – all common. The Pandora is expected here shortly to survey; if I gain the Doctors' [*sic*] acquaintance, I will know his ferns &c, and report, but doubtless his collections will come under your eye.

Apparently, Colenso did not 'gain the Doctors' acquaintance'. No evidence has been found that these contemporary collectors ever met (Ian St. George pers. comm. 2021), nor that Colenso ever collected at Pelorus. The only mention of Pelorus in Colenso's voluminous letters, itineraries and notes compiled by St George (2009) is the single entry quoted above.

Direct examination of the newspaper (*Nelson Examiner and New Zealand Chronicle* 1855) referred to by Colenso, shows that, while there is detailed documentation by Jolliffe of some trees and shrubs, there is no list of the 'more than 140 kinds of Mosses, Jungermanniae, Liverworts & Lichens', rather, Colenso has quoted verbatim the statement in the newspaper. Nevertheless, this entry suggests that Jolliffe was not collecting at random but had the skill to distinguish more than 140 kinds of bryophytes and lichens. As a

Table 3. Comparable records in The Album and Hooker's New Zealand publications.[1]

Album image	Album identification *[Modern identification]*	Album locality	Hooker Species (reference)	Hooker locality for Jolliffe specimen
#050	*[Wijkia extenuata]*	Pelorus	*Hypnum extenuatum* (1867: 482)	Pelorus
#075	*[Sematophyllum jolliffii]*	Wangaroa	*Hypnum jolliffii*[2] (1867: 474)	Northern and Middle islands
#092	Lencodon bartramodes[3] *[Cryptopodium bartramioides]*	Pelorus	*Cryptopodium bartramioides* (1867: 446)	Pelorus
#106	Marchantia *[Marchantia foliacea]*	Hokianga River	*Marchantia foliacea* (1854: 168, 1867: 545)	Hokianga
#120	Fissidens ligulatus[4] *[Fissidens asplenioides]*	Wangaroa	*Fissidens asplenioides* (1867: 407)	Wangaroa

1 Hooker (1854, 1867)
2 Previously undescribed species named by Mitten in honour of Jolliffe
3 Earlier name, mis-spelt but correct identification
4 Earlier name, correct identification

collector, Colenso himself has had a mixed reputation. Bryologist George Scott described him as 'enthusiastic but indiscriminative' (Scott 1971: 739), and J.D. Hooker himself in writing to Colenso, states 'I assure you that miscellaneous scraps such as you sent and all so carefully numbered are not worth the time and trouble of looking over.' (St George 2009: 6). Notwithstanding this comment, Hooker dedicated his *Flora Novae-Zelandiae* to him along with Andrew Sinclair and David Lyall, and there are 749 mentions of Colenso's name in the published works (Hooker 1854, 1867). The present authors believe, that although a prodigious collector, Colenso lacked the delicacy needed to provide specimens of the calibre found in The Album, and for that reason alone would exclude him as its potential collector.

Postage of specimens by ship from New Zealand to England at that time was routine, as witness the numerous packages Colenso sent to Hooker (St George 2009). Hence the W.J. Hooker acknowledgment of Jolliffe specimens in July 1853, more than 2 years prior to the final departure of *Pandora* from New Zealand on 18 Feb 1856 (Byrne 2007: 273), is not anomalous.

Another possible collector for The Album on the *Pandora* is her master, Captain Drury. An electronic search for 'Drury' in Hooker (1854, 1867) revealed a single mention, as 'Capt. Drury, R.N.', in the list of people who 'contributed interesting and important collections.' (Hooker 1867: 11). Perhaps Captain Drury was listed only because of his role in sending Jolliffe's specimens to Kew.

Captain Drury's wife is another possible collector on the *Pandora*. Permission was granted by Francis Beaufort, Hydrographer of the British Admiralty, evidently with some reluctance, for 'Mrs Drury and her Maid Servants' to join the voyage on the *Pandora*. His letter to Captain Drury, reproduced by Byrne (2007: 89), states that 'although I cannot but think that wives are always productive of mischief while on board … I withdraw all opposition to y$^{r.}$ wish … but with the clear understanding that when once arrived on your station they are to reside on Shore.'

Whether this latter directive was obeyed is not known but mentions of Mrs. Drury in Jolliffe's transcribed diary (Jolliffe 1851–1856a) indicate that she did undertake some travel within New Zealand. On April 6th [1852] in Auckland, Jolliffe records 'This morning made some calls with Capt. and Mrs. Drury on several persons including Mrs. Wynyard, the Governor's lady.' While the *Pandora* was anchored at Waiheke to 'fill up with water which is very good and plentiful', members of the Travers family who were on another vessel anchored nearby 'came on board to dine with Captain and Mrs. Drury' (Jolliffe 1851–1856a: 30). Additionally, with her husband and Dr Jolliffe, Mrs Drury visited the mission station at Maraetai, Waikato Heads, staying with the missionary's wife for a week while the survey of that area was carried out (Byrne 2007: 158), and Archdeacon Williams' mission station at Whakato, near Gisborne (Byrne 2007: 159).

Relevant to speculation presented here on the identity of the collector for The Album is the knowledge that John Jolliffe prepared a personal album, 'New Zealand Mosses', with c. 185 pages of pressed specimens from various parts of New Zealand, now held in the Mitchell Library, Sydney (Jolliffe 1851–1856b), which could profitably be the subject of further research.

Examination of images of a few pages indicates that Jolliffe's personal album is not simply a duplicate of The Album, and furthermore the handwriting differs. Nevertheless, there are similarities; images from it reproduced by Byrne (2007: 217) include '*Hypnum marginatum*' the species featuring as specimen #078, in The Album, in both cases collected at 'Pelorus'.

Assembler of The Album

The collector, assembler and identifier of specimens in The Album were not necessarily the same person. There is little evidence relevant to its assembly, except that, as there is no geographic order to the pages, it can be assumed that specimens were not mounted into The Album progressively during the voyage, but rather the assembler had all the dried material on hand. As noted above (David Ashman pers. comm. 2021), the specimens were added to a pre-bound album. Identification may have taken place after assembly of The Album, or while specimens were still loose between collecting sheets prior to mounting.

Possible Identifiers for The Album

In contrast to the high quality of collecting and mounting, identification of the specimens has many shortcomings. There is an indication of some familiarity with bryophyte taxonomy, as authority names are sometimes appended. However, only 78 of 117 specimens of bryophytes are given any identification even to genus level, and there are 18 misidentifications (Table 1).

In some cases, misidentification could have been due to confusion between similar species, e.g., *Dicranum menziesii* (#012) is a misidentification for *Dicranoloma fasciatum*. The polysetous perichaetium and the sheathing perichaetial bracts, clearly seen, are good discriminating features between the species. *Dicranoloma menziesii* was not recognised by the identifier on another page (#069) but tentatively named '*Dicranum (setosum)?*'. *Dicranoloma fasciatum* was known at the time, collected in the Bay of Islands by both J.D. Hooker and Sinclair (Hooker 1854: 66). *Dicranum setosum* has a description and reference to an illustration (Hooker 1854: 66), so information for full identification was available at that time. *Dicranoloma* was later segregated from *Dicranum* (section *Leucoloma*) for the mainly Southern Hemisphere members of the genus (Klazenga 2003), so is a trivial distinction in the present context.

Hypnum smithianum (= *Leptodon smithii*) (#013) is misidentified *Hypopterygium didictyon*. The palmate fronds and elongate setae readily distinguish *H. didictyon* from *L. smithii*.

Two specimens are identified tentatively in The Album as *Hypnum spininervium* (#054, #064). The former specimen is the closely related *Hypnodendron arcuatum*, but the latter is the more distantly related *Camptochaete deflexa*.

Racomitrium Spectabile (#051) for *Racopilum spectabile* is perhaps a case of name confusion between two completely unrelated mosses.

The lack of identification of mosses in the Polytrichaceae, a family of large and distinctive species, would be surprising in a scholarly work. Of the four specimens in The Album, two are correctly identified as *Polytrichum commune* (#042 and #096). Two others are unnamed; the specimens of *Polytrichadelphus magellanicus* (#036) and *Pogonatum subulatum* (# 056) are both readily identifiable from the stature of their shoots, shape of the capsules, and the stance of the dry leaves.

Among the liverworts, catch-all generic names, *Jungermannia* for the leafy liverworts and *Marchantia* for the thallose species, have been applied without further identification. The distinctive *Chandonathus squarrosus* (#28) is un-named, even although the earlier synonym *Jungermannia squarrosa* (Hooker 1854: 127) was available.

Several names in the Album have spelling errors e.g., *Bartramia tormentosa* [*tomentosa*] (#034), *Lencodon bartramodes* [*Leucodon bartramioides*] (#092) and *Leskia* [*Leskea*] *ericoides* (#040), but *Leskea concinna* (#081) is correct. These examples perhaps indicate that the scribe did not have a good knowledge of the names.

Overall, it is likely the identifications were not the work of an expert; the inclusion of two seaweeds and one flowering plant without comment supports this view. We conclude that neither The Album, nor its contents before mounting, passed through the hands of W.J. Hooker nor his son J.D. Hooker at the Royal Botanic Gardens, Kew. Nor is it likely to have been seen by William Wilson, Britain's leading bryologist in the mid-19th century (Lawley 2008), nor by William Mitten who was also recognised as a leading British authority on bryophytes at that time, 'supported (and paid) by the Hookers at Kew' with a 'focussed and broad knowledge of global mosses and liverworts' (Scott 2019).

The identifier/s must have been of lesser stature and, with the handwriting not identified, we are unable at this stage to ascertain who may have identified the specimens in The Album. If John Jolliffe was the collector, it may be that, although primary collections went to Kew, and others went to his personal album, specimens in The Album are duplicates/spares too good to throw away. These may have been identified by himself, perhaps as loose notes with the specimens, or by another botanist. Although Jolliffe must have had a very good collecting eye, we do not yet know how skilful he was as an identifier. Study of his personal Album (Jolliffe 1851–1856b) could shed further light on these unknowns.

CONCLUSION

There is good evidence that the specimens in The Album were collected from H.M.S. *Pandora* during the Great Survey of New Zealand, 1851 to 1855, and the most likely candidate is the ship's surgeon, John Jolliffe. This conclusion is supported both by contemporary sources (Anon 1852; Colenso [1839]; Drury 1854; Great Britain Hydrographic Department 1874; Hooker 1854, 1867; Jolliffe 1851–1856a, b; *Nelson Examiner and New Zealand Chronicle* 1855), and by authoritative modern accounts (Byrne 2007; Maling 1999; McKinnon *et al*. 1997). Those records show that the ship, or Jolliffe himself, visited all localities named in The Album, except Pakaraka. The date when *Pandora* worked the coasts of New Zealand, from 1851 to 1856, is compatible with the dates for The Album derived both from the bryophyte names used i.e., between 1854 and 1867, and from structural features of the book itself, given by appropriate experts as mid to late 19th century.

It is established that Jolliffe was a prodigious collector of New Zealand mosses and liverworts that found their way to the Hookers of Kew, and for which he was given individual thanks by both W.J. Hooker (Byrne 2007: 264); and J.D. Hooker (Hooker 1867: 11). The existence of a substantial personal album of 'New Zealand Mosses' (Jolliffe 1851–1856b), not yet examined in detail, further attests to his zeal as a bryophyte collector and herbarium maker.

The quality of the specimens in The Album, including delicate and ephemeral fruiting structures, is impressive. However, from the errors and omissions in the naming of the specimens we suggest that it did not pass through the hands of any of the foremost bryologists of the day. Nevertheless, this volume is a significant record of the non-vascular flora at a time when bryological exploration of New Zealand was still in its infancy.

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Dr Jessica E. Beever, beeverj@landcareresearch.co.nz | https://orcid.org/0000-0002-6828-2687
Dr John E. Braggins, jandtbraggins@gmail.com

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APPENDIX 1: URL links to each image number.

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