Alexander McKay: New Zealand's first scientific photographer

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ABSTRACT: Alexander McKay (1841–1917) explored many parts of New Zealand while working as a fossil collector and geologist for the New Zealand government between 1873 and 1902. He was also a keen amateur photographer, taking photographs of geological features and documenting the impact of the 1888 and 1901 Canterbury earthquakes. He invented a telephoto lens about 1890, and later developed techniques for photographing fossils and microscopic thin sections of rocks. All of McKay's varied photography was aimed at illustrating the scientific work he was undertaking, and as such he can be designated New Zealand's earliest scientific photographer.

KEYWORDS: Alexander McKay, 1888 North Canterbury earthquake, 1901 Cheviot earthquake, scientific photography, photomicrographs, Awatere Valley, telephoto lens, historic photographs.

Introduction

Alexander McKay (1841–1917; Fig. 1) is a legendary figure among New Zealand geologists. As a young man, he emigrated from Scotland in 1863, hoping to make a living on New Zealand's goldfields. James Hector, director of the New Zealand Geological Survey and Colonial Museum, employed him as a fossil collector in 1873 and soon recognised his scientific ability. Based at the Colonial Museum in Wellington, McKay became a pioneering geologist, gradually acquiring an encyclopaedic knowledge of New Zealand's rocks, minerals and fossils (Bishop 2008). Largely self-taught, he relied on Scottish geologist Charles Lyell's *Principles of Geology* (1830–33) and his own observations to develop geological interpretations. He was the first to recognise that New Zealand's mountains were young and still rising, a concept not generally accepted until the mid-twentieth century. Reporting on the 1888 North Canterbury earthquake, he was the first in the world to record and photograph transcurrent (sideways) movement on a fault rupture.

Fig. 1 Alexander McKay, aged about 50 (Cyclopedia Company Ltd 1897: 174) (photo: McKee and Gamble, Wellington).

Fig. 2 Large cliff-face exposure of limestone at Weka Pass, North Canterbury. The controversial break between the Weka Pass Stone (above) and the Amuri Limestone (below), thought to represent the Cretaceous–Tertiary boundary, is indicated by the arrow. From microfossil studies, it is now known that the rocks above and below the contact are of early Oligocene age, and that the Cretaceous–Tertiary boundary is lower in the sequence. June 1886. GNS Science BW4882 (photo: Alexander McKay).

Throughout his career, McKay was interested in photography and took photographs to illustrate aspects of his varied geological work. Although this has been noted by previous writers (Cooper 1993; Bishop 2008), the full extent of McKay's photographic work has never been documented. In part, this is because the record is incomplete, and McKay wrote only a single report on his photography (McKay 1890b). I have assembled a list of the available information in the Appendix to this paper, and present a chronological account of his photography below.

Early photographic experience

In 1867, McKay found employment at an isolated farm, Lake Ohau Station in South Canterbury, where he met his future wife, Susannah. He was interested in setting up a business as a commercial photographer, and in early 1868 he spent several weeks in Christchurch being tutored in wet-plate photography at Edward Wheeler & Co. in Cathedral Square, for which he paid £5 (Bishop 2008: 94).

Difficult times meant that McKay had to undertake a variety of labouring jobs over the next three years, and his aspirations for a photographic career disappeared. In 1871, while prospecting a coal seam in the Ashley Gorge, he met geologist Julius Haast, who offered him a temporary job as a field assistant. Based on Haast's recommendation, in 1873 McKay was employed by Hector, initially as a fossil collector and later as assistant geologist for the New Zealand Geological Survey. He stayed in the same position, based at the Colonial Museum in Wellington but travelling extensively around New Zealand, for the next 30 years.

There is no known record of any photographic work undertaken by McKay through the 1870s, although draughtsman John Buchanan, who also worked for Hector in the Colonial Museum, used photographs as a guide for his drawings of fossils and biological objects, and these may have been taken by McKay.

During the early 1880s, the wet-plate process was superseded by the development of mass-produced dry plates, which meant that it was feasible to take photographs of geological features in the field and later process the plates in a darkroom. Hector wrote to his London agent, James Farmer, asking him to procure a portable camera suitable for geological fieldwork. Farmer responded to Hector on 13 June 1883, saying that he had obtained 'a complete set of Photographic Apparatus', and dispatched it to New Zealand by sea (Mildenhall & Nathan 2013: 78; Nathan 2015: 151–152). It is tantalising that we have no details of the equipment, but it seems likely that it included the camera McKay used for his photography through the late 1880s.

Items 1 and 2 in the Appendix list approximately 200 photographs of geological features taken by McKay before 1892. The majority were taken in 1888–89 as part of investigations into the 1888 North Canterbury earthquake (see below), but there are also small groups of photographs from Northland, Wellington, Nelson, the Mokihinui coalfield and the Weka Pass area in Canterbury. Some of these may have been taken as early as 1884, but we cannot be sure of any dates apart from those of the Weka Pass group, which were taken when McKay visited the area on 14–16 June 1886 (McKay 1887).

During the late nineteenth century, there were ongoing arguments among New Zealand geologists about the location of the Cretaceous–Tertiary boundary (Oldroyd 1972). Although this is clearly marked by an unconformity in classic sections in the United States, Britain and Europe, there appeared to be no break in New Zealand. Hector believed that the contact occurred at a minor break between the Amuri Limestone and Weka Pass Stone in North Canterbury, but this was contested by Haast and Canterbury College geologist Frederick Hutton. Hector sent McKay to investigate the well-exposed sequence of beds at Weka Pass, and McKay took a series of photographs to supplement his report (McKay 1887), one of which is reproduced as Fig. 2. Unfortunately, it was too expensive to publish photographs at the time, and the report is illustrated by sketches and cross sections.

1888 North Canterbury earthquake

A large earthquake in North Canterbury on 1 September 1888 caused considerable damage to the area around Hanmer. McKay was sent to investigate, and left Wellington on 27 September. To reach the damaged area, he travelled up the Awatere Valley, where he was able to examine the fault rupture on the Awatere Fault caused by the 1848 Marlborough earthquake. Grapes (2009, 2011: chapter 11) gives a detailed day-by-day account of the journey and McKay's impressions. The line of the 1848 rupture was still clear, and McKay noted that it had not broken again in 1888. As he travelled south over Jollies Pass, the damage increased, until he found widespread ground rupture near the Waiau River along the line of what we now know as the Hope Fault. At Glynn Wye Station, McKay noted sideways (transcurrent) offset of 2–3 m, marked by offset fences. He wrote up his report promptly on his return to Wellington in October 1888. It appears that he did not have a camera with him during this trip, because he comments that 'No pen, and scarce the most graphic touches of a graphic artist could give a just and complete rendering of the river bank … Photography properly directed might do something' (McKay 1890a: 6).

McKay was back in Marlborough in November 1888. Hector had decided that he should create a geological map the Awatere Valley and the adjacent part of east Marlborough over the summer of 1888/89 to join up with the work he had done earlier in the Clarence Valley (McKay 1886). Hector was clearly convinced by the value of photography, because McKay returned to Marlborough with his camera, a supply of glass plate negatives and instructions about some features to be photographed. From November 1888 to February 1889, McKay took more than 100 photographs of geological features and the 1848 rupture of the Awatere Fault. He also returned to the middle Clarence Valley to photograph geological features he had seen during earlier fieldwork (Hector 1890: xxxvi). It was probably towards the end of this period that McKay travelled south to the area affected by the 1888 earthquake around the Waiau River, photographing the damage and rupturing along the Hope Fault that he had observed several months earlier. A selection of these photographs is shown in Figs 3–9: Figs 3 and 4 show the 1888 rupture on the Hope Fault; Fig. 5 shows the 1848 rupture on the Awatere Fault; and Figs 6–9 show different aspects of the geology.

In referring to McKay's report on the 1888 earthquake, Hector (1890: xxxi) noted that 'Mr McKay's report gives the results of his observations made on the spot, and he has supported them by means of a large series of well-selected photographs, which will be published as soon as possible'. Unfortunately, this did not happen, and it more than a decade passed before a small group of photographs was published (McKay 1902).

Fig. 4 Figure lying on the ground indicating the size of the vertical offset on the 1888 fault rupture (about a metre) – considerably less than the 2.6 m horizontal offset. GNS Science BW4770 (photo: Alexander McKay).

Fig. 5 Prominent scarp and trench between Lee Brook and Castle River in the upper Awatere Valley. This marks the line of the rupture along the Awatere Fault during the 1848 earthquake. When it was photographed 40 years later, there was little erosional modification. GNS Science BW4945 (photo: Alexander McKay).

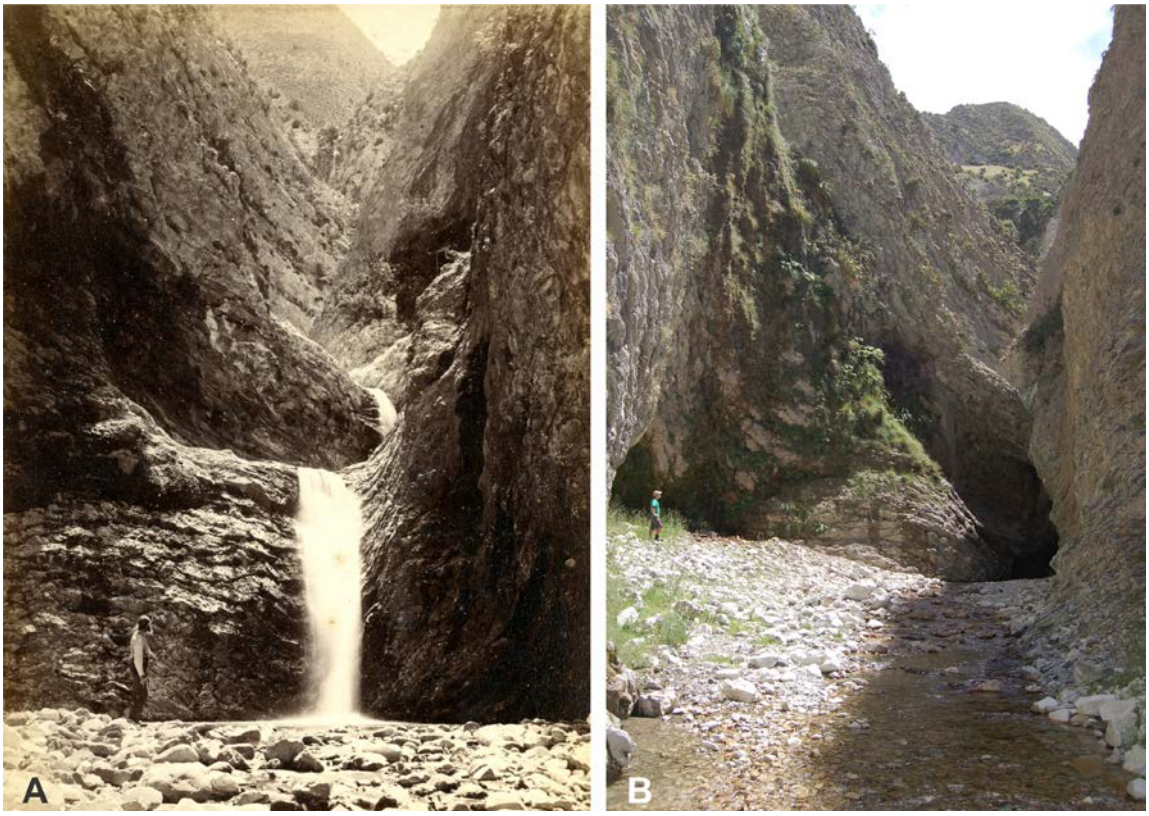

Fig. 6 Entrance to the limestone gorge in Swale Stream, Clarence Valley. Late Cretaceous limestone dips (slopes) away from the viewer at about 45 degrees. A, view in 1888–89; GNS Science BW4756 (photo: Alexander McKay). B, view in 2008 (photo: James Crampton). Since the earlier photograph was taken, aggradation has built up the level of the stream, and there have been further changes following the 2016 Kaikoura earthquake.

Fig. 7 Exposure of steeply dipping Great Marlborough Conglomerate (Miocene) in Hevers Creek, near Kekerengu, containing large blocks of Amuri Limestone. The widespread occurrence of this unit persuaded McKay that there had been uplift of mountains and erosion over the last 10 million years. GNS Science BW 4885 (photo: Alexander McKay).

Fig. 8 Steeply dipping basalt dikes cutting across gently dipping Cretaceous sediments, Winterton River (a tributary of the Awatere River). GNS Science 4885 (photo: Alexander McKay).

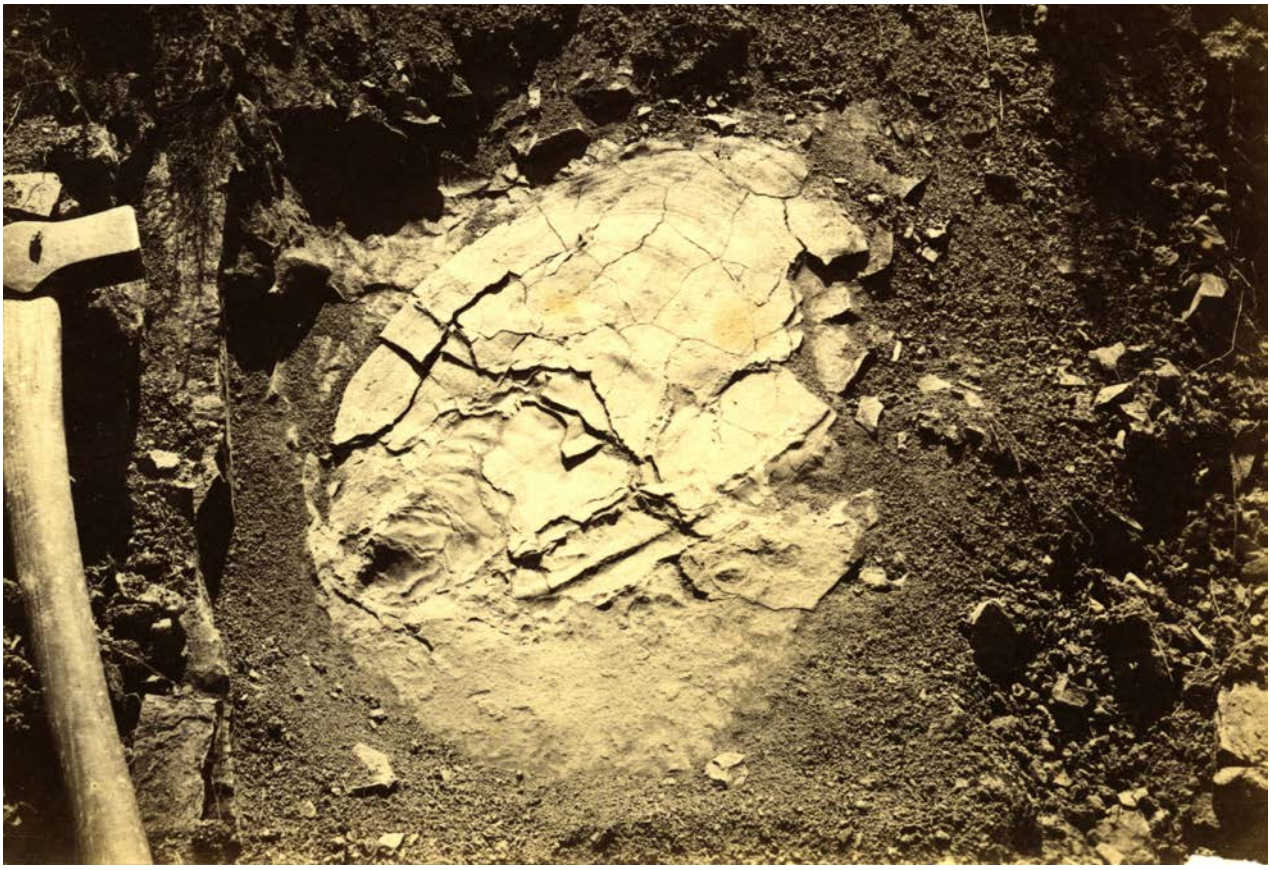

Fig. 9 Large inoceramid bivalve fossil in Cretaceous sediments. Location uncertain. GNS Science BW4971 (photo: Alexander McKay).

Development of a telephoto lens

On 13 August 1890, McKay gave an address to the Wellington Philosophical Society titled 'On some means of increasing the scale of photographic lenses and the use of telescopic powers in connection with an ordinary camera' (New Zealand Institute 1890). In essence, this was a description of how he had developed a telephoto lens that could be attached to his camera (Fig. 10). McKay illustrated the talk with examples of photographs he had taken. There was great interest from the audience, and Hector commented that it was the product of years of work by McKay and considerable expense. McKay subsequently published the talk as a paper in the *Transactions of the New Zealand Institute*, but unfortunately without any illustrations (McKay 1890b). The difficulties of magnifying distant objects had long been a matter of frustration to McKay, and his solution was to design the lens like a telescope. He described the technical issues of getting enough light through the lens so that the image could be focused on the glass screen at the back of the camera, as well as the problems of eliminating fuzziness caused by spherical and chromatic aberrations. Patterson (2009) gave a modern summary of how McKay had prepared an extension tube that could be attached to the camera, but that was still portable enough to be taken into the field.

One of the best-known examples of a photograph taken by McKay with his telephoto lens is of a ship in Wellington Harbour from Tinakori Road near the Shepherds' Arms Hotel (Fig. 11). The vessel was previously believed to be the Russian warship *Vestnik*, which visited Wellington in 1886 (Main 1972: 101; Bishop 2008: 13, 157–158), but this appears to be based on an incorrect inference. A note about the image in McKay's handwriting, in item 2 in the Appendix, refers to the 'Flag ship of the German Squadron'; this has been identified by Perrin (2017) as SMS *Sophie*, which visited Wellington in November–December 1890. The date is important, as it indicates when McKay was getting good results with the telephoto lens. It does not appear that McKay was using his telephoto lens much,

if at all, before 1890. The large batch of photographs he took in North Canterbury and Marlborough in 1888–89 does not include any telephoto shots.

There is little doubt that McKay developed his telephoto lens independently, and in his entry in the Cyclopedia Company Ltd (1897: 175) he claimed to be its inventor. Patterson (2009: 365) summarises attempts to develop a practical telephoto lens in Britain and Europe, culminating in a patent application by Thomas Dallmeyer of London in 1891. The issue of priority is open to debate, but McKay was clearly a pioneer in this area of photographic technology.

Fig. 10 Telephoto lens developed by Alexander McKay, and described in his 1890 paper. Private collection (photo: Hamish Campbell).

Photography through a microscope

In 1892, McKay was given increased responsibility. As part of a reorganisation under the new Minister of Mines, Richard Seddon, the control of geological work was transferred from Hector to the Undersecretary of Mines (Nathan 2015: 196), who delegated this work to McKay. His title was initially Mining Geologist, later Government Geologist. For the next decade, McKay worked almost entirely on economic geology.

The Coromandel Peninsula (then also known as the Cape Colville Peninsula) had become the centre of underground gold mining in New Zealand. In 1896–97, McKay undertook a major survey of the region, discussing the geology and mineral prospects, making a large rock collection (McKay 1897) and taking photographs. Almost all the rocks in the region are volcanic, and there was considerable disagreement among local geologists about the nomenclature of the fine-grained rocks, which were often hydrothermally altered (McKay 1900). McKay decided that the only way to resolve the issue was to submit his rock collection to an overseas expert for examination by microscope. William Sollas, FRS, a professor of geology at the University of Oxford, was contracted by the New Zealand Mines Department to provide a detailed sample-by-sample report on 500 rocks submitted to him by McKay – 402 from the Coromandel Peninsula, and 98 from other parts of New Zealand. Rock slices (thin sections) were prepared from the samples in Britain for petrological examination by Sollas using a polarising microscope. The rocks and thin sections were subsequently returned to New Zealand.

Fig. 11 (below) Photographs taken from the same position above Tinakori Road, Wellington, looking towards the harbour on the same day in November–December 1890. A, view with normal lens, with Shepherds' Arms Hotel in the foreground. The masts of a ship can be seen faintly in the upper centre. Alexander Turnbull Library ½-021850-F (photo: Alexander McKay). B, view with telephoto lens showing the SMS Sophie, part of the visiting German squadron, about 2.5 km away. Alexander Turnbull Library ½-021856-F (photo: Alexander McKay).

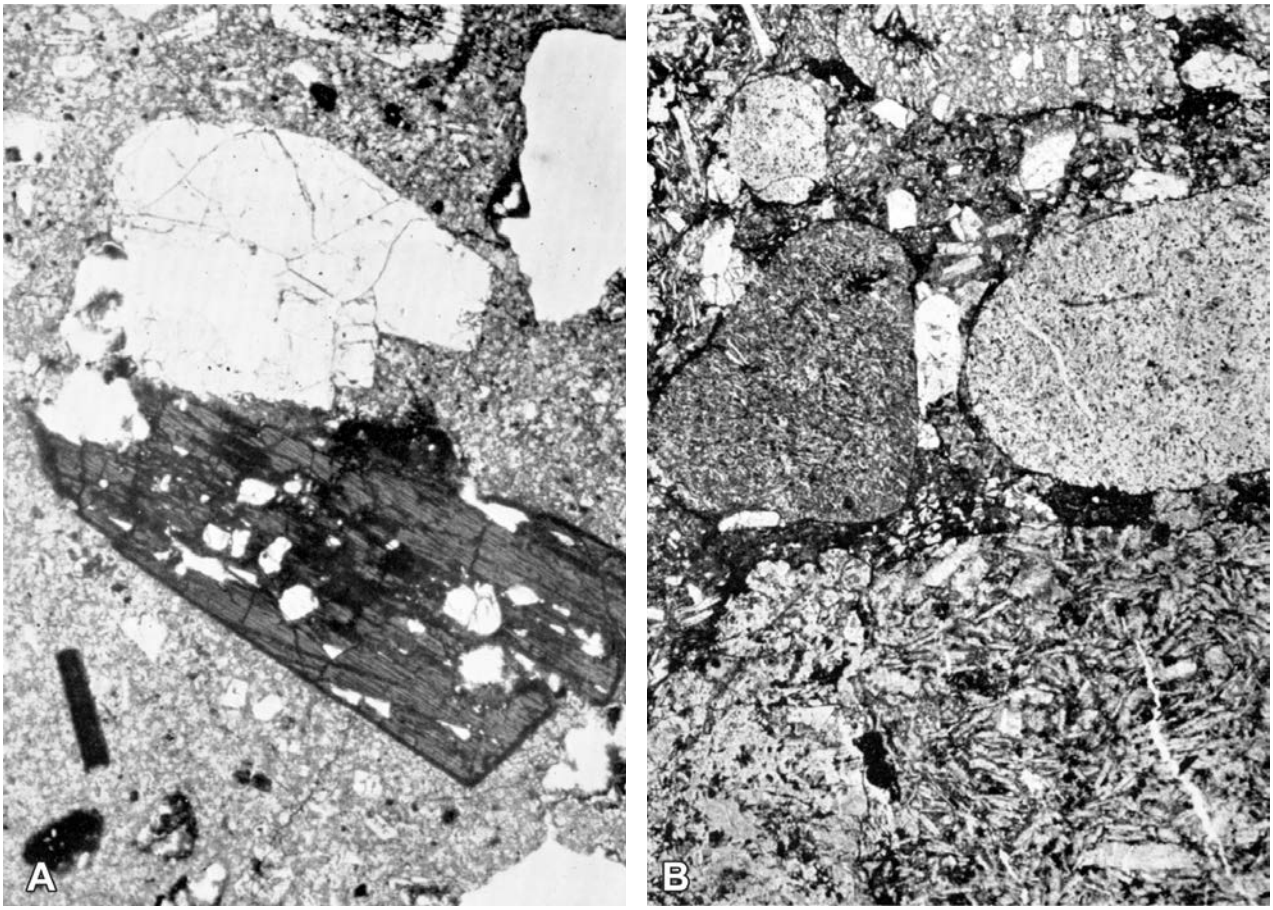

Fig. 12 Examples of photomicrographs published as full-page illustrations in The rocks of the Cape Colville Peninsula. Vol. 1 (Sollas & McKay 1905). A, hornblende dacite from Cabbage Bay, with large, clear phenocrysts of plagioclase and a single large phenocryst of dark brown hornblende (centre) (photo: Alexander McKay). B, volcanic conglomerate band in pre-Cenozoic greywacke, from a road cutting near Coromandel. The thin section shows that the pebbles include a variety of volcanic lithologies (photos: Alexander McKay).

While there is no evidence that McKay undertook any microscope petrography himself, he turned his attention to photographing thin sections. When Sollas's reports were received, McKay wanted to ensure that they were printed in full, with adequate illustrations. The resulting two-volume monograph, *The rocks of the Cape Colville Peninsula* (Sollas & McKay 1905, 1906) is one of the largest and most elaborate publications on New Zealand geology, containing 32 landscape views and 177 full-page photographs of thin sections (photomicrographs), all taken by McKay (examples are shown in Figs 12 and 13). It was recorded in the *1906 New Zealand Mines Record* that his 'greatly enlarged photographs of rock slides accompanying his work on the *The rocks of the Cape Colville Peninsula* have received high commendation from the Director of the Geological Survey in Great Britain, who in a letter of acknowledgement expressed a doubt whether such a class of work could be done in the Old Country' (Anon. 1906).

One of the unusual rocks described by Sollas was a peculiar streaky rhyolitic rock that was found around Waihi, and was known locally as wilsonite. Sollas was clearly puzzled by the rock (Sollas & McKay 1905: 124–125), which we now recognise as a variety of ignimbrite containing welded and flattened pumice fragments. McKay's photographs (Fig. 13) are possibly the first published photographs of this rock type.

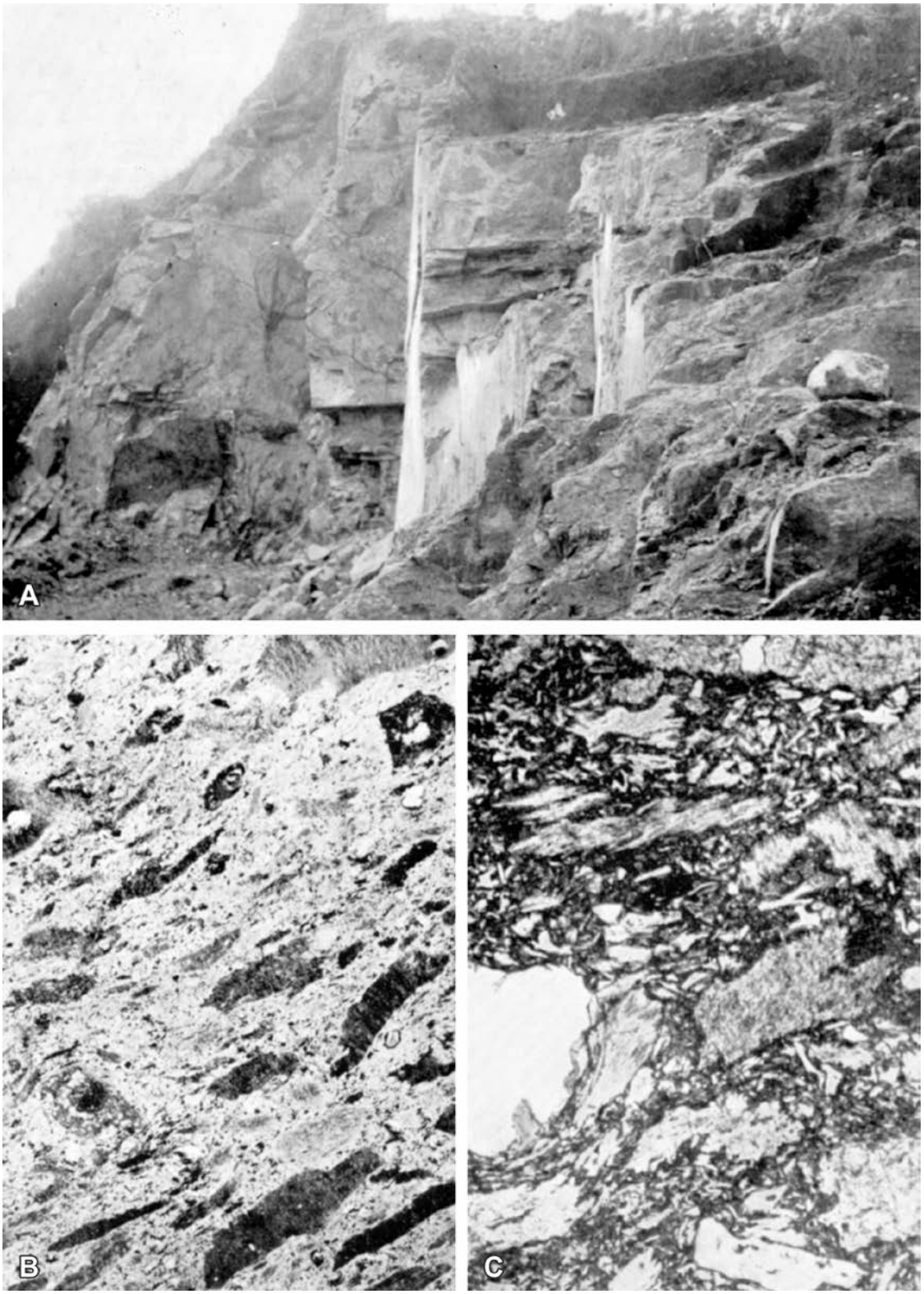

Fig. 13 Wilsonite, now recognised as a variety of ignimbrite, published in *The rocks of the Cape Colville Peninsula. Vol. 1* (Sollas & McKay 1905): A, cliffs of Wilsonite in a quarry in the Ohinemuri Valley, near Waikino; B, cut slab showing flattened pumice fragments in a fine-grained matrix; C, thin-section view, again showing flattened pumices and a few phenocrysts. (photos: Alexander McKay).

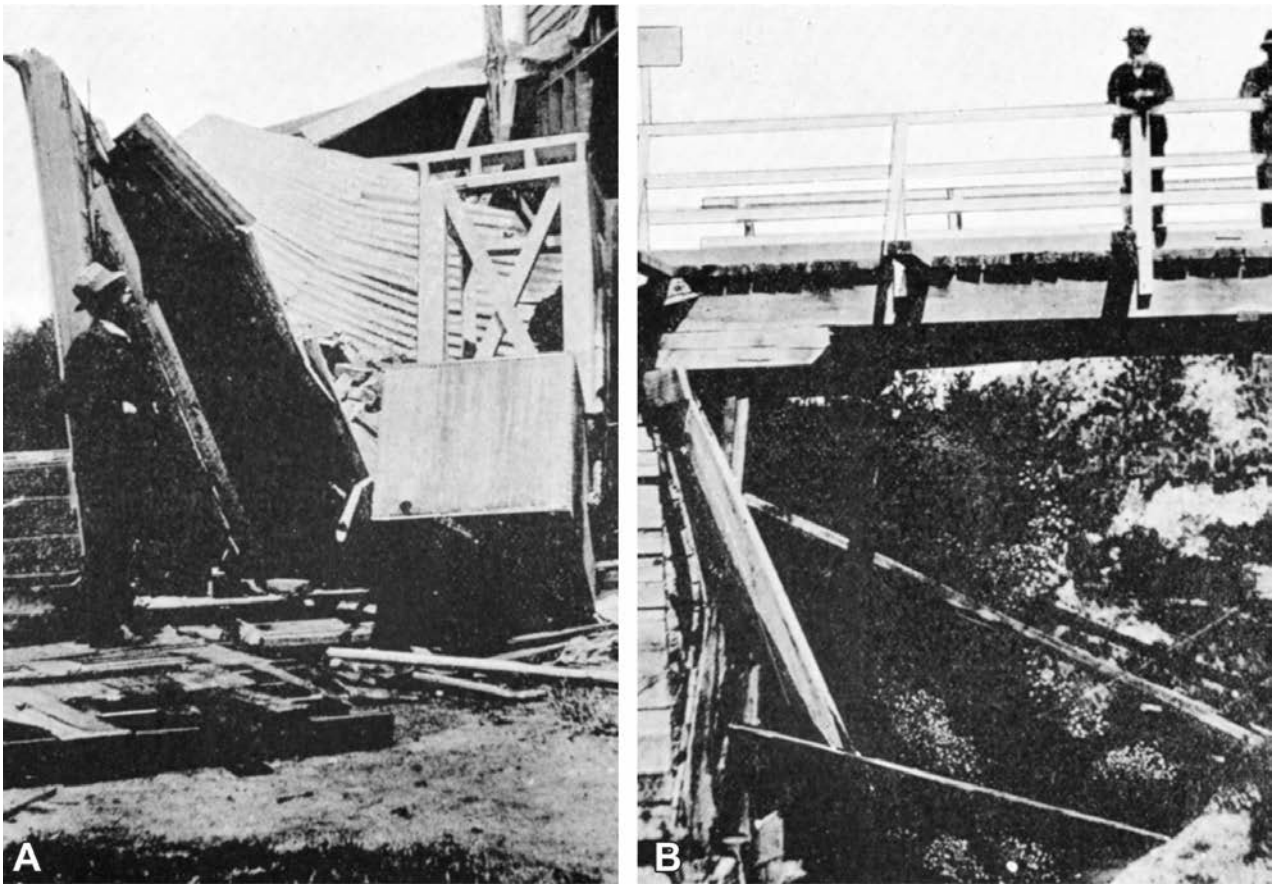

Fig. 14 Two examples of earthquake damage during the 1901 Cheviot earthquake, published in Alexander Mackay's account of the earthquake (McKay 1902): A, the rear of Penberthy's Hotel, Cheviot, after the earthquake of 16 November 1901; B, damage to the bridge over Swamp Creek, Sinclair Road, Cheviot (photos: Alexander McKay).

1901 Cheviot earthquake

On 16 November 1901, the North Canterbury region was shaken again by a large earthquake that was centred near the town of Cheviot, with aftershocks continuing for more than two months. McKay was sent to investigate and report on the impact of the earthquakes. Based on his experience in Marlborough, he looked for a major fault rupture, but was unable to find a geological cause for the earthquakes. The buildings in Cheviot were predominantly single-storey wooden bungalows, and the damage was not overwhelming, although most chimneys had collapsed.

McKay had his camera with him and took 76 photographs of the damage around Cheviot (Bishop 2008: 173). His report on the earthquake was written up promptly for publication by the Government Printer (McKay 1902) and included 12 photographs of damage around Cheviot in 1901 (Fig. 14). McKay took the opportunity to include parts of the text of his report on the 1888 earthquake, as well as six previously unpublished photographs.

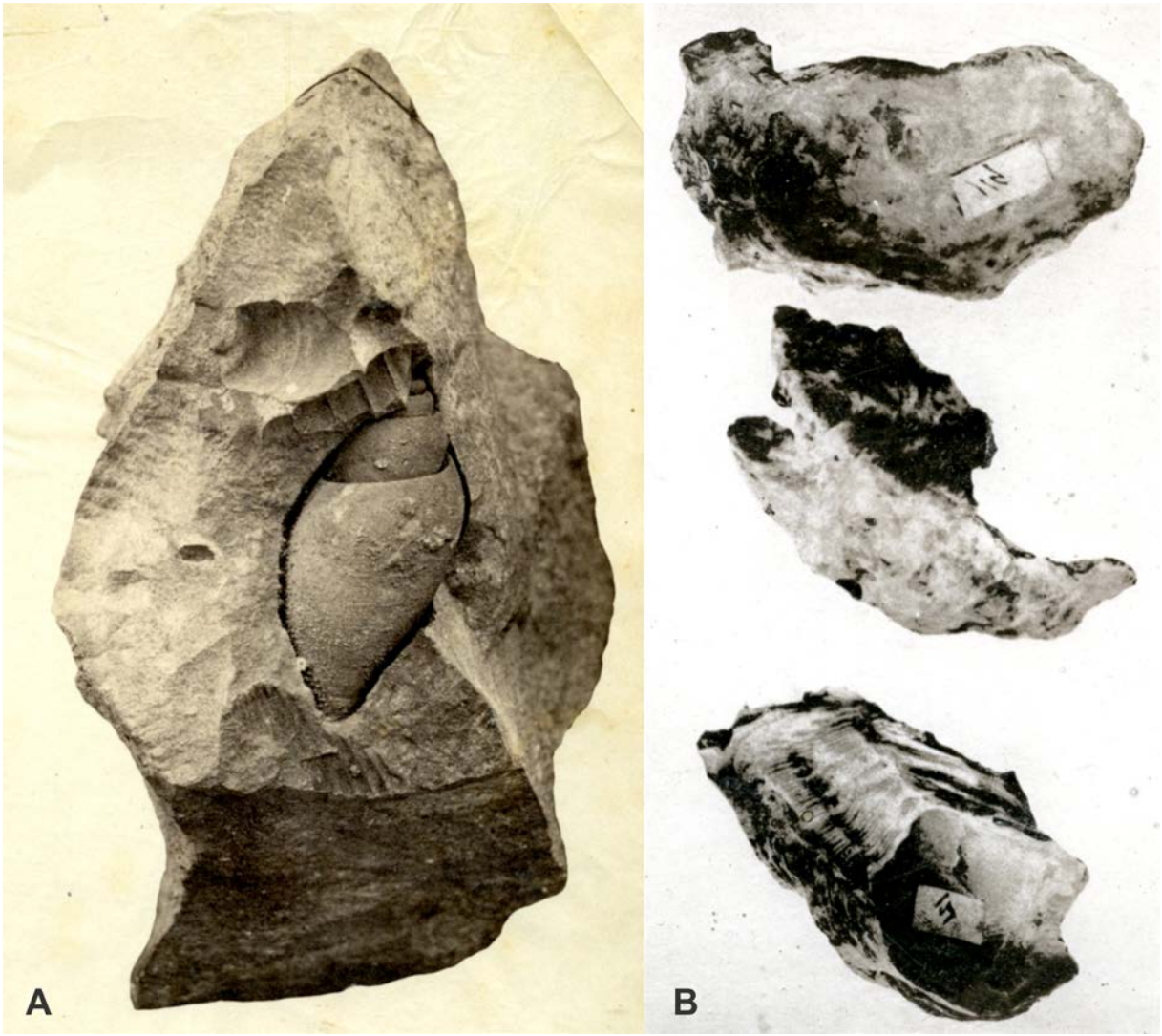

Fig. 15 Photographs of fossils held in the John Buchanan collection, GNS Science. It is likely that the photographs were taken to assist Buchanan in making drawings of fossils and biological specimens. A, fossil gastropod, partly enclosed in rock matrix. It is possible that McKay coated the fossil with fumes of ammonium chloride, giving a white coating that reduces shadows (photo: Alexander McKay). B, different views of a fossil oyster specimen. (photo: Alexander McKay).

Photographing fossils

In March 1902, McKay was feeling unwell. His doctor diagnosed heart problems, and stated that he was no longer fit enough to undertake fieldwork. This marked the beginning of the final stage of McKay's career, when he was confined to the office.

McKay had originally been employed by Hector as a fossil collector, and over the years had amassed a huge volume of fossil material that was stored within and under the Colonial Museum. McKay himself regarded his fossil collections as his most significant contribution to New Zealand geology (Bishop 2008: 179), and had experimented with photographing fossils (Fig. 15). Hector had intended to have the fossils identified and described, but this never happened. In 1904, after Hector's retirement, McKay started the enormous task of sorting out and repacking the fossils he had collected so that they could be moved out of the museum. It must have been frustrating for McKay to see the fruits of his collecting being moved into storage, and he experimented with photographing the fossils so that an accessible record would be available. In a memorandum to the Undersecretary of Mines, he mentions–

> a style of photography which has not previously been accomplished. Hitherto the photographing of natural objects, such as rocks and fossils, has, in comparison with drawings laboured under the disability of being accompanied by shadows that, seemingly unavoidable in connection with the photograph, are not necessarily a part of the drawing. To take photographs that would not show the ordinarily accompanying shadow became with me first a dream, next a matter of experiment, and finally an accomplished fact. I know not whether I should claim for my achievement the rank of a discovery, but certain it is that it enables the production of process blocks equal to those from drawings, and at much less cost (Anon. 1906).

Unfortunately, McKay gave no technical details of how he obtained his shadowless photographs. His original memo was accompanied by 37 photographs of rocks and minerals, but these are not included in the file held in Archives New Zealand in Wellington (R17869560).

What happened to McKay's photographs?

It is tantalising that there is so little technical information about how McKay took his photographs or the equipment he used. Although money for photographic material was presumably supplied by the New Zealand Geological Survey or Mines Department for his scientific photographs, he apparently retained all the negatives and most of the prints.

In McKay's will, dated 10 October 1916 – some months before his death – he left 'all my photographic apparatus, material for producing photographic prints, and all my photographic negatives' to his older son, William McKay (McKay n.d.). The photographic prints were to be split between his widow, Adelaide (McKay had remarried following the death of Susannah), and his younger son, Duncan. A few items, including the telephoto lens, have been passed down the family, but almost none of the photographs have been located. The evidence (as detailed in the Appendix) indicates that McKay took more than 500 photographs through his career, and it is hoped that publication of this paper may assist in the identification of more of his photographs if they have survived.

Conclusion

Although Alexander McKay is renowned as a geologist, his name is little known among nineteenth-century New Zealand photographers. Both Knight (1971) and Main (1972) note his development of the telephoto lens, but there is no mention of his other photography.

In McKay's busy life, photography was largely an activity he carried out in his spare time, but because of his keen interest he achieved high-quality results. There is no evidence that he took any personal or group images, and it appears that he regarded photography essentially as a way of recording the geological features he observed as well as the impact of events such as the 1888 and 1901 earthquakes. Over the years, McKay extended his techniques to include telephoto and scientific photography. He used his photography to illustrate scientific features, and can thus be categorised as a scientific photographer – probably the first who can hold that title in New Zealand. The ethnologist Augustus Hamilton was also taking scientific photographs in the 1890s (McCredie 2017), but McKay appears to have started several years earlier.

When McKay started taking photographs in the 1880s, there was little possibility of publishing the images – it was simply too expensive, and line drawings on woodcuts were used instead. Although McKay's photographs of the 1888 earthquake would have been of immediate interest, James Hector had no funds available for their publication, either in the *Reports of Geological Exploration or the Transactions of the New Zealand Institute*. A decade later, when McKay was Government Geologist, and he took the opportunity to ensure that his report on the 1901 Cheviot earthquake was well illustrated, including with it his photographs of the 1888 earthquake, which had never been published. *The rocks of the Cape Colville Peninsula* (Sollas & McKay 1905, 1906) is a landmark publication because it is one of the earliest scientific monographs illustrated by photographs, entirely produced in New Zealand by the Government Printer. In addition to his talent as a scientific photographer, McKay had the drive and organising ability to ensure that his illustrated manuscripts were completed and published.

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Appendix: Inventory of photographs taken by Alexander McKay

Listed here are the various sources from which I have been able to discover information on photographs taken by Alexander McKay. None of his original glass plate negatives has been located, and the photographs that survive are either prints, copies of prints or images in publications.

1 GNS Science, Lower Hutt

GNS Science holds a collection of 147 half-plate contact prints, mounted on card, that were clearly intended for display. Many of the prints have labels on the back, some in McKay's handwriting. There are a number of duplicates – the older ones are albumen prints, with a sepia tint, and later ones are on silver gelatin printout paper (Wayne Barrar, pers. comm., 2017). The majority of the prints appear to have been taken in 1888–89, and feature the Clarence and Awatere valleys, as well as earthquake damage in the Waiau Valley and especially around Glynn Wye Station. There are also small groups of photographs taken at Weka Pass and around Red Rocks in Wellington. The original mounted prints are held in the security room at the GNS Science Library. They have been photographed, and the negatives are in the GNS Science photo collection, listed as 4616–4627, 4751–4762, 4766–4795, 4844–4867, 4875–4902 and 4936–4976. A small collection of prints of photographs of fossils is also held in the John Buchanan collection; some of these were subsequently used as the basis for drawings by him.

2 Hocken Collections, University of Otago, Dunedin

The Hector papers contain a memo in McKay's handwriting (Ms-0445-2/13) titled 'Lantern Slides of New Zealand Scenery by Alexander McKay', consisting of a list of 173 photographs. It seems probable that McKay's negatives were converted to lantern slides for the talk that Hector and McKay gave to the Wellington Philosophical Society on 8 August 1891. The brief descriptions include the images taken in 1888–89 in Marlborough noted above, but also small groups of photographs from Northland, the Mokihinui coalfield, Nelson and Wellington. None of the lantern slides has been located.

3 Alexander Turnbull Library, Wellington

Photographs of six prints (021849, 021850, 021851, 021855, 021856 and 021857), copied from an album loaned by Mrs A.H. Parker, Hukanui, in 1963. These include four photographs taken by McKay in Tinakori Road, Wellington, demonstrating his telephoto lens, as well as images of a settlement in the Manawatu Gorge and the hotel at Mitchells, West Coast. There is also a single image (051913) showing the Kelburn School under construction.

4 *Report on the recent seismic disturbances within Cheviot County* (McKay 1902)

In the first part of this document, McKay repeats part of his report on the 1888 earthquake (McKay 1890a), and includes six images that had not been previously published. Prints of these are held at GNS Science. He records having taken 76 photographs of the area affected by the 1901 earthquake (Bishop 2008: 173), of which 12 are reproduced in the report. None of the originals of this large group has been located.

5 *The rocks of the Cape Colville Peninsula* (Sollas & McKay 1905, 1906)

All the photographic illustrations in these two volumes were apparently taken by McKay. There are 32 ground shots of different parts of the region in Volume 1, as well as a total of 218 photomicrographs of thin sections of different rocks in both volumes.

6 New Zealand Geological Survey Bulletin 2 (Park 1906)

This volume contains 17 photomicrographs of thin sections from the region around Alexandra in Otago (facing pages 46 and 48) taken by McKay.