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Earliest photograph of Athabasca and Dome Glaciers, Alberta
La première photographie jamais prise des glaciers Athabaska et Dome, en Alberta.

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Résumé de l'article

On présente ici un tirage numérisé de cette photographie et on la compare à une photographie prise en 1998 présentant une vue similaire. La photographie de Mary Schäffer semble avoir été prise en 1906, selon des renseignements tirés de son journal et du contexte de l'image même. On parle brièvement des changements survenus depuis 1906 en ce qui à trait à l'extension du glacier et la végétation.

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Notes

EARLIEST PHOTOGRAPH OF ATHABASCA AND DOME GLACIERS, ALBERTA

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ABSTRACT A digitally enhanced copy of the first photograph showing Athabasca and Dome Glacier is presented and compared with a similar view taken in 1998. The photograph, taken by Mary Schäffer, appears to date from 1906 based on contextual evidence from her journals and the image. Changes in the glacier extent and vegetation cover during the present century are discussed briefly.

RÉSUMÉ *La première photographie jamais prise des glaciers Athabaska et Dome, en Alberta.* On présente ici un tirage numérisé de cette photographie et on la compare à une photographie prise en 1998 présentant une vue similaire. La photographie de Mary Schäffer semble avoir été prise en 1906, selon des renseignements tirés de son journal et du contexte de l'image même. On parle brièvement des changements survenus depuis 1906 en ce qui à trait à l'extension du glacier et la végétation.

INTRODUCTION

The Athabasca Glacier (Fig. 1) is the most visited and photographed glacier in Canada. It has hitherto been assumed that the earliest photograph of this glacier is one published by Mary Schäffer in 1908 (Schäffer, 1908). However, the Schäffer Collection in the Whyte Museum of the Canadian Rockies in Banff, Alberta contains another negative showing the Athabasca Glacier (Fig. 2) that appears to predate the 1908 photograph and which would therefore be the first known photograph of the Athabasca Glacier. This note discusses the possible age of that photograph and compares it with an equivalent image taken in 1998. Changes in the extent of Dome and Athabasca Glaciers and in the appearance of the vegetation cover over this 90-year interval are discussed briefly.

METHODS

In 1981 the senior author located a print of the original of Figure 2 in the photographic archives of the Whyte Museum of the Canadian Rockies in Banff, Alberta (Whyte Museum Accession Number NG10-92). This photograph was used to determine the 1906 positions of Dome and Athabasca Glaciers (Luckman, 1986, 1988). Although the glaciers are clearly visible on the original photograph, the foreground is extremely dark and no detail is discernible.

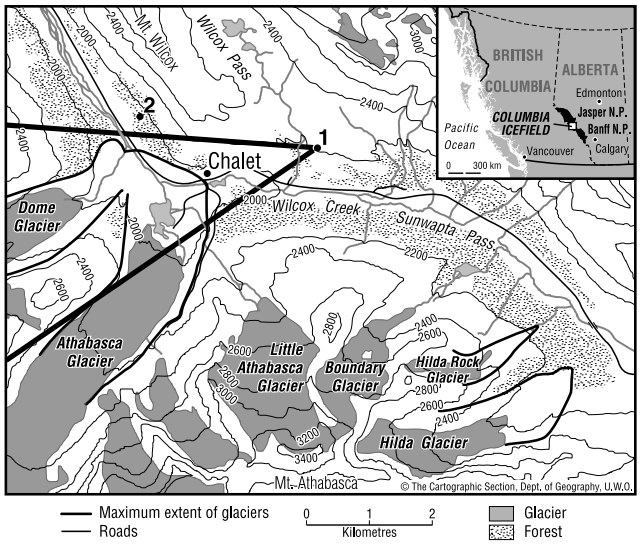

FIGURE 1. Location map showing Athabasca and Dome Glaciers, Sunwapta Pass and Wilcox Pass. The two Schäffer photographs discussed in this paper were taken from Point 1 (Figs 2 and 3) and Point 2 (Schäffer, 1908, 1911). The two heavy lines from Point 1 indicate the field of view of Figure 2.

Carte de localisation montrant les glaciers de Dome et d'Athabasca, ainsi que les cols de Sunwapta et de Wilcox. Les deux photographies de Schäffer dont on parle ici ont été prises à partir du point 1 (fig. 2 et 3) et du point 2 (Schäffer, 1908 et 1911). Les deux lignes tracées à partir du point 1 donne l'angle de prise de vue de la figure 2.

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FIGURE 2. Athabasca and Dome Glaciers photographed from Sunwapta Pass. The upper photograph was taken by Mary Schäffer in 1906. The lower photograph was taken by B. H. Luckman on July 7th, 1998. Athabasca Glacier occupies the middle ground of the 1906 photograph: Dome Glacier is fed by several icefalls from the Columbia Icefield, which can be seen on the skyline in the 1998 photograph.

Les glaciers d'Athabasca et de Dome photographiés à partir du col de Sunwapta. La photographie du haut a été prise par Mary Schäffer, en 1906, tandis que la photographie du bas a été prise par B.H. Luckman, le 7 juillet 1998. Le glacier d'Athabasca occupe la partie centrale de la photographie de 1906 : le glacier de Dome est alimenté par plusieurs cascades de glace en provenance du Champ de glace Columbia qu'on peut apercevoir à la ligne d'horizon de la photographie de 1998.

The image in the upper part of Figure 2 is a digitally enhanced reproduction of this photograph. It was developed by digital scanning of an approximately two-fold enlargement of the original photograph using a Linotype-Hell Flatbed scanner with a resolution of 300 pixels per inch (each pixel is *ca.* 0.008 mm wide). The bright, highly reflective glacier areas were "masked" and remain unaltered. The grey scale of the remaining pixels was "stretched" to enhance contrast in the darker part of the image using Adobe PhotoShop version 5.0.2. This manipulation enhanced the detail of the vegetated areas in the foreground of the image and allows comparison with the present landscape. The lower image in Figure 2 is a composite scanned from three overlapping colour slides taken on July 7th, 1998 from a similar viewpoint. The grey-scale rendition of the small lake (centre foreground) and the bluff along Wilcox Creek (bottom left, foreground) have been lightened to make these reference points more visible on the later photograph. Slight differences in perspective between these two images result from the use of different cameras, compositing of the later image, and difficulties in repositioning at the exact location from which the earlier photograph was taken. The view shown in the 1998 photograph extends slightly further upvalley to show the present snout of the Athabasca Glacier more clearly.

Figure 3 is a partial enlargement of Figure 2 that shows foreground detail and the snouts of both glaciers. The geometry of the 1998 image is unchanged, but the earlier image has been compressed slightly in the vertical dimension to match reference points.

FIGURE 3. Athabasca and Dome Glaciers photographed from Sunwapta Pass in 1906 (right) and 1998 (left). This image is an enlargement of the lower right corner of Figure 2. The letters are explained in the text.

Les glaciers d'Athabasca et de Dome photographiés à partir du col de Sunwapta en 1906 (à droite) et en 1998 (à gauche). Cette image est un agrandissement du coin inférieur gauche de la figure 2. On trouvera l'explication des lettres A et B dans le texte.

HISTORICAL BACKGROUND AND DATE OF THE PHOTOGRAPH

W. B.Wilcox "discovered" the Athabasca Glacier in 1896. Collie, Stutfield and Woolley took photographs of this area on their climbing trip in 1898. Collie's map of the Athabasca Glacier (Collie, 1899; Stutfield and Collie, 1903) indicates that Athabasca and Dome Glaciers were confluent at that time, but the published account of the expedition (Stutfield and Collie, 1903) does not include a photograph of the Athabasca Glacier. Woolley climbed Mount Wilcox but "the haze interfered seriously with photography" (Stutfield and Collie, 1903, p. 123). No photographs from any of these visits have yet been located.

Mary Schäffer published the first photograph of the Athabasca Glacier in 1908 and again in 1911. The photograph shown in Figure 2 has not previously been published. It shows Athabasca and Dome Glaciers from the east and was taken from a position in Sunwapta Pass above the present Icefield Campground (Point 1, Fig. 1). However, the date of this photograph is not recorded. The photograph was found in a container faintly marked "1906", but the collection was in such confusion and had been handled by a sufficient number of people that it is not possible to verify whether the negative was still in its original envelope (E. Cavell, personal communication, October 1981).

Some inferences about the dates of Mary Schäffer's two photographs of Athabasca Glacier can be made from a knowledge of her travels in this area (Schäffer, 1907, 1908, 1911) and the images themselves. As with all early travellers, Mary Schäffer approached the Columbia Icefield from the south via the North Saskatchewan valley and Sunwapta Pass. In 1906 she got as far as Wilcox Pass and describes the weather conditions as follows: "Still it seemed hard lines to view the Wilcox Pass in a blanket of mist, to watch the little Sun Wapta, 500 feet below us, flowing into the far-away Athabasca, and apparently dissolving into a low-hanging cloud, to tread the summit of the pass and gaze not upon distant unknown mountain ranges, but on a white woolly blanket, which soon tossed snow and sleet in our faces and forces a retreat" (Schäffer 1907, p. 112).

This description fits the original dark print of the image quite well (upper diagram, Fig. 2) and supplies some circumstantial evidence for a 1906 date for that photograph. It could have been taken on a later trip but that seems unlikely. Similar weather conditions existed on July 4th, 1907 (Schäffer, 1911, in Hart, 1980, p. 30), but photographs of Wilcox Pass in 1907 show considerably more snow than is visible in Figure 2 and Schäffer comments that, on this occasion, the cameras were "useless". Based on her text and other photographs, conditions would have offered a clear view of the mountain summits during her 1907 and 1908 visits. The most logical reason for taking the photograph shown in Figure 2 in such weather conditions is that it was the first time she had seen this view and it represented the furthest point reached on the 1906 trip. As Mary Schäffer's party did not get beyond Wilcox Pass in 1906, the photograph published in 1908 must have been taken in 1907 or 1908.

The two known Schäffer photographs of the Athabasca Glacier are taken from different viewpoints. Figure 2 is taken from a position about one kilometre east of the Athabasca Glacier, looking westwards (Point 1, Fig. 1). The photograph published in 1908 shows a detailed view of the snout of Athabasca Glacier, taken from the west (Point 2, Fig. 1), looking towards Mount Athabasca. This image shows several snowpatches on the ice-front, whereas none are visible

on the lower glacier in Figure 2, suggesting that the photographs were taken in different years. Unfortunately, the published photograph is also undated. The photograph in Schäffer (1908) illustrates an article on the 1907 trip; the same picture is included in the narrative of the 1908 expedition in "Old Indian Trails" (Schäffer, 1911). No specific publication date is given for the 1908 issue of the *Canadian Alpine Journal* (Vol. 1, no. 2), but the Treasurer's Report (p. 324) is dated 23 May 1908. As the early journal went to press late in the year, it is possible that a photograph taken in August, 1908 could have been included in Volume 1, n° 2. The published photograph could therefore have been taken in 1907 or 1908, though a 1907 date appears more likely. Although it is now highly unlikely that the precise dating of both photographs can be resolved, it seems most probable that the upper image in Figure 2 was taken in 1906 and the published photograph (Schäffer, 1908) in 1907.

COMPARISON OF THE 1906 AND 1998 PHOTOGRAPHS

The relatively debris-free eastern edge of the Athabasca Glacier is clearly visible in Figure 2, although the distal, debris-covered western portion of the glacier is difficult to distinguish. The clear trimline on the west (far) side of Dome and the conspicuous triangle of trees between the western lateral moraine of the Athabasca Glacier and the eastern lateral moraine of Dome Glacier provide convenient reference points. The summits and icefield proper are hidden in clouds in the 1906 image. Wilcox Creek drains Sunwapta Pass and is clearly visible in the foreground of both images in Figure 2. Two large boulders and a conspicuous bedrock outcrop are visible in the foreground of Figure 3 at point A.

CHANGES IN ATHABASCA AND DOME GLACIERS

Luckman (1988) estimated that the 1906 icefront of the Athabasca Glacier was approximately 200 m upvalley of the 1843-44 Little Ice Age maximum limit. The relatively debris-free icefront receded *ca.* 1 km between 1906 and 1981 (the most recently documented position) and about 200 m since that time. Sunwapta Lake (middle distance, Fig. 2) began forming *ca.* 1940. The glacier ceased calving into the southern margin of this lake *ca.* 1968 at a point now occupied by a delta formed by the proglacial drainage flowing into the lake. In addition to a recession of over one kilometre, there has been a spectacular thinning of the Athabasca Glacier. The lateral moraine crest beyond Sunwapta Lake is approximately 150 m above the lake elevation. The 1906 image suggests that the upper glacier surface was probably within 20 to 30 m of the lateral moraine crest at that time and that the glacier has probably lost *ca.* 100 to 120 m thickness at its present frontal position.

In 1906, Dome Glacier terminated at a small moraine on its lower outwash and receded *ca.* 700 m between 1906 and 1981 (Luckman, 1988). Although the debris-covered margins of Dome Glacier and its distance from the camera position make it difficult to provide precise estimates, the marked differences in the long profile of the glacier suggest that most of the volumetric loss from Dome Glacier has been by downwasting rather than by frontal recession.

CHANGES IN VEGETATION COVER

Vegetation on the valley floor in the foreground of Figure 2 is a wet shrub thicket comprised primarily of willows (*Salix* sp.). The lower treeline in Sunwapta Pass is the result of excessive moisture on the valley floor. The upper temperature-controlled treeline is at about 2150 m and can be seen in the distance between Dome and Athabasca Glaciers and on the slopes beyond. The subalpine forest is mainly a mix of Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*), with occasional individuals of whitebark pine (*Pinus albicaulis*) and lodgepole pine (*Pinus contorta*).

The two photographs are taken from a position overlooking the treeline ecotone and show striking differences in tree density and morphology. The large tree clumps evident in the foreground of the 1998 image (at upper treeline and on the lower slope, see Fig. 3) occur in areas that are either treeless or occupied by low, dark vegetation in the 1906 image. Though faint, the few trees that can be distinguished in the foreground of the earlier image are spindly with poorly developed canopies and some degree of flagging. Although they are poorly resolved, it is possible that some of the low dark areas in the 1906 image are krummholz mats from which erect stems later emerged in response to warmer climate. Many of the erect stems emerging from krummholz mats elsewhere in Sunwapta Pass date to the early 1900s (Kavanagh, unpublished data). Figure 3 clearly shows major changes in the appearance of the treeline ecotone over this 90-year period with expansion of existing clumps, increases in tree density and the dominance of large erect trees. The present tree limit (the highest elevation of trees on the slope) is not visible on Figure 3 and it is not possible to determine whether the actual tree limit has changed on this slope. However, the elevation of treeline (the upper limit of erect trees, *sensu S*latyer and Noble, 1992) has clearly advanced as a result of the increased density of trees and changes in both growth form (krummholz to erect stem) and the rate of vertical growth.

The greatest changes in vegetation have occurred on the lower slopes of Mount Wilcox (Area B, Fig. 3). In 1906, the area now occupied by the chalet and parking lot appears to have been largely treeless (however, see Kavanagh and Luckman, 1995) with a thin patch of forest immediately upslope. By 1998, this slope is densely covered by a forest of Engelmann spruce, subalpine fir and lodgepole pine. A detailed reconstruction of treeline dynamics in a plot adjacent to the slope shown in this photo confirms that most trees on this slope established since the early 1900s (Kavanagh, 2000; Luckman and Kavanagh, 1998). Evidence from establishment patterns suggests that tree recruitment has taken place during periods of warmer summer temperatures in the last 75 years (Luckman and Kavanagh, 1998). However, available tree ages from this slope suggests that tree-limit does not appear to have changed significantly over this period.

There are a number of individual trees scattered on the valley floor in the lower left of the 1998 photo in Figure 2. These trees are not discernible in the 1906 photo, but that may be due to the poor quality of the photo rather than their total absence. Most of these trees have established in slightly elevated and drier locations on the valley floor and the few that have been cored date to the 1920s and 1940s (Kavanagh, unpublished data). These photos suggest tree establishment is also taking place on drier sites on the valley floor. Little apparent change has taken place in the forest cover on the slopes flanking Dome Glacier, although the detail of the older image in these areas is not very sharp.

HUMAN IMPACTS

The 1998 image shows the modest changes needed to service over one million day visitors a year to a World Heritage Site within a National Park. These include an improved visitor centre and chalet (built 1995-1996); an expanded tour bus parking lot (other parking lots are hidden by the building); staff accommodation (foreground centre left, Fig. 2 lower); a modern highway and former gravel extraction site (adjacent to the staff quarters). All these structures replace older, smaller facilities that followed the first road access to the area in the late 1930s.

FINAL COMMENT

The matching of historical and contemporary landscape photographs is a powerful tool for documenting environmental change in climate-sensitive landscapes (*e.g.* Skovlin and Thomas, 1995). However, suitable old photographs are rare and often of poor quality. The original Schäffer photograph discussed in this paper was of limited use as it was greatly underexposed and only showed detail of the glacier surface. The advent of easily accessible digital-processing software and personal computers allows the manipulation of such images to recover additional information. The photographs in Figure 2 now provide the most dramatic illustration available of changes in Athabasca and Dome Glaciers during the 20th century. Perhaps it is time to revisit other photo archives and re-evaluate the information content of other poorly exposed images that were considered of marginal utility in the past.

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