Dart Glacier data archive
Message from Jane Forsyth:
I am about to retire and would like to let the SIRG members know about some material that we hold in GNS Science in Dunedin & Lower Hutt. The information (see below) is largely in the form of old-fashioned photos and hard copy documents. I just thought it might be good to let other people interested in glaciology know, in case any are interested in historical research. The information is archival, ie no new material is being added. So please disseminate this as you see fit and get back to me (sandymount@actrix.co.nz) if anything is unclear.

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for material in Lower Hutt (Avalon) GNS, library@gns.cri.nz

TWO GNS COLLECTIONS OF INTEREST TO GLACIOLOGISTS

DART GLACIER ARCHIVE
GNS Lower Hutt and GNS Dunedin
Documentation by Jane Forsyth
June 2011

SUMMARY
A collection of unpublished documents and photographs relating to the Dart Glacier project 1974-1988. The collection will be housed in the GNS Main Library, Lower Hutt. Additional data is in the GNS filing system, Dunedin (E39/463). These notes written by Jane Forsyth, GNS Science, Dunedin, December 2010 to June 2011.

BACKGROUND
The Dart Glacier is located in Mt Aspiring National Park, Otago, New Zealand. It rises on the Main Divide of the Southern Alps and is a major source of the Dart River, which flows into Lake Wakatipu. The glacier is on map sheet E39 (NZMS 260 1:50 000 series) and CA10 (Topo50 1:50 000 series).

In 1974, Dr Graham Bishop (District Geologist at the Dunedin office of New Zealand Geological Survey, Department of Scientific and Industrial Research) began setting up the glacier research project. A small hut was installed near the glacier in March 1975, and monitoring of ice flow and melting began. More details about the research methodology and participating staff are given in the unpublished documents. Ice movement and ablation rates were calculated until 1985.

Immediate reports on the field work, and some analysis of data from the project, are filed in the GNS filing system (see E39/463). At least three scientific papers were drafted, but not published (1982, 1988, 1992). A thesis was completed through Otago University Geology Department (Nicol, S. 1988; abstract published in Newsletter of Geological Society of New Zealand, 79: 22-23). Also in 1988, a general-interest/high school level book was published: Vanishing Ice - an introduction to glaciers based on a study of the Dart Glacier; Graham

Bishop and Jane Forsyth; published by John McIndoe in association with New Zealand Geological Survey, DSIR. Notes and drafts exist for other 'popular' articles by Graham Bishop.

Funding for the project lapsed around 1985 and Graham Bishop retired in 1996. A few photographs were taken as opportunity arose until 1995, mainly by Jane Forsyth. The hut was destroyed by avalanche in January 1995, and the remaining equipment was collected by Mt Aspiring National Park staff and returned to Dunedin. The steam drill was given to Geography Department, University of Otago, for their glacier research programme in about 2006 (?).

Papers and photographs relating to the project were stored in the Dunedin office of New Zealand Geological Survey's successor organisations. They were used to prepare public information/signage for Department of Conservation (2004), and an installation project by artist Jo Woolley (2007), but otherwise untouched. In 2010, the documents were sorted for storage and archiving at GNS Science, Lower Hutt.

The project and Graham Bishop's vision have proved to be prescient. Glacial recession in the Southern Alps was being noticed by trampers and climbers, but was not being documented or measured systematically in most places. Exceptions were the Ministry of Works & Development mass balance monitoring project on the Ivory Glacier in Westland, 1969–75 (Peter Anderton, Trevor Chinn), and a New Zealand Geological Survey project on the Tasman Glacier in Mt Cook National Park (Ian McKellar). Today, global warming and the potential of glaciers to indicate climate change are much more widely understood than they were in 1974. As some of the draft documents make clear, Graham Bishop was also interested in the hydrological and economic effects of glacier melting, particularly in the role of glaciers as water storage and the effects on the Clutha hydroelectricity schemes of changing river flows in the future.

CONTENTS

Hut Books
Exercise book "Dart Glacier Data" 1975–1982. Contains details of glacier measurements 1975–1981 (front) and readings of max/min thermometer 1975–1982 (back). One loose leaf.

Exercise book "Hut Book" 1975–1993. Record of hut visitors including scientific parties and trampers/climbers. Book broken into several parts.

Photographs – historic
Historic photos were used to calculate and compare the extent of ice and snow through the years, and illustrate glacier recession.

Folder "Dart Early Photos" 1913–14 to 1983. Contains dated photos of Dart Glacier and surrounds from various sources, each year in separate envelope. Earliest (1913–14) from Hocken and Canterbury Museum collections (Major Bernard Head expedition). 1930s to 1960s contributed by trampers/climbers following Graham Bishop's appeal in Alpine Club journal etc. See correspondence file for letters to and from some of the donors of these photos. From 1975, consists of photographs related to the Dart Glacier project taken by Graham and other workers. At back of folder, sheets of black and white contact prints of glacier measurement work, hut and people.

Box file "Dart from various points also Other NW Otago Glaciers". 1914–1987. Contains black and white and colour photos from various sources, grouped according to the place they were taken from. Envelopes:
-Dart from Mt Cunningham 1934, 194?, 1984, 1987
-Dart mid valley to Cascade Saddle
-Dart from Cascade [Saddle]or CW ['carriage wall' or 'carriage way', a prominent moraine on the Dart side of Cascade Saddle]
-Dart from Liverpool 1914, 1935, 1986
-Dart: the "Edwards view" 1935–1987
Also photographs of other glaciers in Otago:
-Andy Glacier 1967, 1977, 1979, 1987, 1989 [see also 'Vanishing Ice' figs 51–53]
-Bennett photos 1967–8: Joe, Bonar, Andy, Snow White, Bettne, Donald, Passchendaele, Haast Range [Mike Bennett, deer culler in 1960s]
-various glaciers NW Otago with list of photographers. Each photo has photographer, place and date. See correspondence file for letters to/from donors of these photos.

Photographs – photo points
Five formal photo points were established around the glacier and were re-occupied regularly so that comparisons of ice level and snow extent could be made. Locations of photo points are shown inside each folder. Within each folder photos are filed in date order.

Folder "PP 1 & PP 1A" 1975–1993

Folder "PP 2" 1975–1993

Folder "PP 3 & upper névé" 1975–1995

Folder “PP 4” 1976-1982

Folder “PP 5 terminal” 1976-1995

Box file “Dart Glacier dated pix and photo points PP1 - PP5”. 1974 - 1993. Contains black and white and colour prints and negatives. Filed in date order and by location.

Photographs - miscellaneous viewpoints
Folder “Carriage Wall* and Miscellaneous”
Contains photos by various people, many from the tramping route between Cascade Saddle and Dart Hut. Includes ice-level lines painted below hut (1977-1990).
*[The ‘carriage wall’ or ‘carriage way’ is a prominent moraine on the Dart side of Cascade Saddle].

Folder “Dart Glacier hut and people” 1975-1995. Includes photos of hut from lifting in by helicopter to destruction by avalanche, and of people and equipment working on the glacier.

Box “Dart Glacier project negs and photos dated”. 1984 - 1995. Contains negatives and some prints, mainly by Graham Bishop, Jane Forsyth and Scott Nicol, of subjects in and around the Dart Glacier. Filed in date order. Many prints are filed elsewhere, e.g. Photo Point files, but negatives are filed here.

Box “Various spare prints by DLH”. Contains mainly black and white, large format (8 x 10 inch) duplicate prints of photos that are filed elsewhere in the archive. Most were taken in 1977 & 1978 but not all are dated. Photographer is DL Homer. Many photos have negative number (see GNS Science photo library system).

Envelope “Miscellaneous spare photos, many dated”. Contains duplicates of photos filed in other folders.

Photographs - vertical aerial
Vertical aerial photos were taken for the project by New Zealand Geological Survey photographer DL (Lloyd) Homer. They were used to calculate extent of ice and moraine, and plot movement of individual boulders and landslide debris on the glacier from year to year, to gauge long term flow rates. Photos cover glacier and terminal area, taken in mid-late summer to show minimum snow cover.

Folder “Dart Glacier Verticals (contact prints)”. 1976-85. Contains contact prints of vertical aerial photos, mainly black and white,

Folder “Dart Gl verticals (DLH)”. 1976-83. Contains enlarged vertical aerial photos, same images as contact prints in folder.

Box file “Dart Glacier Verticals (DLH) duplicates”. 1976-85. Contains enlarged vertical aerial photos, same images as contact prints in folder.

Folder "Dart Verticals (enlargements). 1985. Contains enlarged vertical aerial photos, in black and white and colour, from Lloyd Homer photography of January 1985.

Folder "Air fotos – verticals – marked with data". Various years. Contains prints of vertical aerial photos with various features marked, e.g., the hut, rock points on both sides of glacier, lateral moraines, talus fans, ice lineations. The markings, made by Graham Bishop, are not explained but the purpose of some can be guessed.

Photographs and diagrams
Brown-paper folder: Original images for book "Vanishing Ice" including photos, slides, and line diagrams.

Brown-paper folder: Display-quality large prints and parts of a display. Contains various large prints of Dart Glacier area in colour and black-and-white.

Notes and calculations
Box file of Working notes and drawings, annotated photos, and some tabulated data, subdivided into several categories:
- glacier area, volume, cross section, mass balance
- snow (firn) line diagrams for different years
- temperature/weather/climate related to glacier behaviour
- ice ablation calculations from monitoring poles
- ice velocity calculations from monitoring poles
- ice velocity calculations from boulders [marked on aerial photos]
- rates of downwasting and glacier retreat

GLACIER INVENTORY
GNS Dunedin
Documentation by Jane Forsyth
June 2011

Background
Dunedin office houses a collection of photographs, negatives and maps of New Zealand glaciers, part of the NZ Glacier Inventory compiled by Trevor Chinn (formerly MWD and IGNS, now NIWA/Retired). Historically, the photograph collection began at Alpine Processes Group, Water and Soil Division, Ministry of Works and Development, Christchurch (1977) and continued while Trevor Chinn was at DSIR Geology & Geophysics and IGNS (Christchurch & Dunedin). When Chinn was made redundant from IGNS and moved to NIWA (ca. 1998), the collection was deemed to be GNS intellectual property.

The inventory consists of photographs, negatives, maps, and an NZGS report. NIWA, Dunedin (Andrew Willsman) has related photographs, negatives, documents referring to the collection, a scanned version of the index maps, and a complete electronic index of the photographs.

The collection has been indexed in the GNS Bibliographic database (June 2011).

Glacier Inventory and Glacier Snowline Survey
The Glacier Inventory (part of the World Glacier Inventory) is documented in NZGS report G163 (Chinn, 1991) and on a set of maps (NZMS1, 1:63,360) with the glacier outlines marked. These maps have been scanned by NIWA and GNS is expecting an electronic copy.
Mac/Hypercard/XL files also document the glacier information (with NIWA and Chinn). These files include a complete index of all the photos in the Glacier Inventory (therefore including the photographs in the 8 drawers).

Note that the annual "Glacier Snowline Survey" uses a sub-set of about 50 "Index" glaciers. This survey continues to the present under NIWA, and the photos and negatives of these "snowline index" glaciers have been removed from the Glacier Inventory. The Snowline Survey is documented for the GNS years by immediate reports and science reports (e.g. IGNS Science report 96/6).

Photo collection - physical description
The photo collection is in 8 drawers of card-file cabinets (each cabinet approximately 40 x 50 x 20 cm). It comprises black and white and colour photographic prints, labelled with the numbers assigned to the glaciers, the catchment, and in some cases with geographic features named. The number of photos is not known but is certainly in the thousands.

The negatives are housed separately in 5 cardboard boxes (currently in Delia Strong's room, G5, GNS Dunedin). An index of these (and a lot of other negatives, and a disk with scans) is with them. See I/Dunedin/Jane/Chinn Glacier Negative Index.

Indexing system
Each photo has a number, coded for year/film/frame number, to link to its negative (housed separately). The photos are in envelopes and sub-envelopes, according to their minor river catchment (basin) and sub-area (sub-basin), within the file drawers.

Example: major catchment (i.e. first-order river that flows to the sea) = Rakaia (685), minor catchment (i.e. second-order river) = Avoca (685-F), sub-area = Avoca-Greenlaw, glacier numbers = 8-10. All the photos of glaciers 8-10 within the Avoca catchment, through the years 1977-1998, are in the same envelope. Glaciers are numbered sequentially in a clockwise direction within each basin. Every basin has several sub-areas, each with its own envelope.

The numbering system for the catchments is documented in NZGS report G163; it is derived from a 1956 hydrological index system ("Catchments of NZ" by Soil Conservation and Rivers Control Council). The major (first-order) catchments are:

North Island (Ruapehu)
Waikato 434
Whangaehu 331

Wanganui (North Island) 333
[current spelling Whanganui]

Eastern South Island
Wairau 601
Awatere 602
Clarence 621
Waiau (Canterbury) 646
Waimakariri 664
Rakaia 685
Ashburton 688
Rangitata 693
Waitaki 711
Clutha 752

Westland
Cascade 859
Arawhata 836
Waiatoto 864
Turnbull 866
Okuru 867
Haast 868
Paringa 875
Mahitahi 877
Makawhio (Jacobs) 878
Karangarua 880
Cook 882
Waikukupa 886
Omoeroa 887
Waiho 888
Waitangitaona 892
Whataroa 893
Poerua 896
Wanganui (Westland) 897
Waitaha 901
Mikonui 903
Hokitika 906
Taramakau 911
Buller 932

Fiordland
Waiau (Southland) 797
Wairaurahiri 803
Seaforth 824
Breaksea 828
Doubtful 832
Thompson 834
Charles 837
Sutherland 843
Poison Bay 844
Arthur 846
Milford-Cleddau 847

Kaipo 850
Hollyford 851

The negatives are indexed chronologically by year and film.

NIWA, Dunedin (Andrew Willsman) has a complete electronic index of the photographs, up to 2008.

Subject matter
The photographs mainly show glaciers and snow areas in the Southern Alps of NZ, and also cover Ruapehu and the higher parts of Fiordland. A few envelopes have photos of geomorphology or landscapes only (no glaciers). Almost all the photos are obliques taken from the air, but a few photos were taken from the ground. Although the "Glacier Snowline Survey" photographs as many as possible of the selected glaciers each year, the rest of the glaciers in this collection are not re-photographed. Most of these photos are from the late 1970s to the late 1990s with some from the 1950s (1955?).

A few of the photographs have no glaciers, but show landscapes (e.g. Fiordland South Coast, Shotover, Hurunui). These are noted in the Bibliographic Database entry.

Photographers
Most of the photos were taken by Trevor Chinn during flights at the end of each summer. Some are by Lloyd Homer, and the earliest are from an RNZAF Canberra flight in 1955(?). There are also scanned negatives and positives from a "CAA" flight in 1960(?), provided on disk and held both electronically and in the negative collection. Photos generally are not labelled with the photographer's name but the series number (e.g. CN1234 for Lloyd Homer/GNS photos) gives a good indication of the photographer. Some further information is in the negatives index (q.v.).

Uses
The changing shape and size of snow/ice areas over the years (1950s to 1990s) can be seen from the photos. David Barrell (CSIGG project, GNS Monograph 27) and Delia Strong (Tasman Glacier project) have used them for this type of study. The photos have also been used for their depiction of rock structure and landforms (e.g. Simon Cox during Qmap Aoraki compilation).