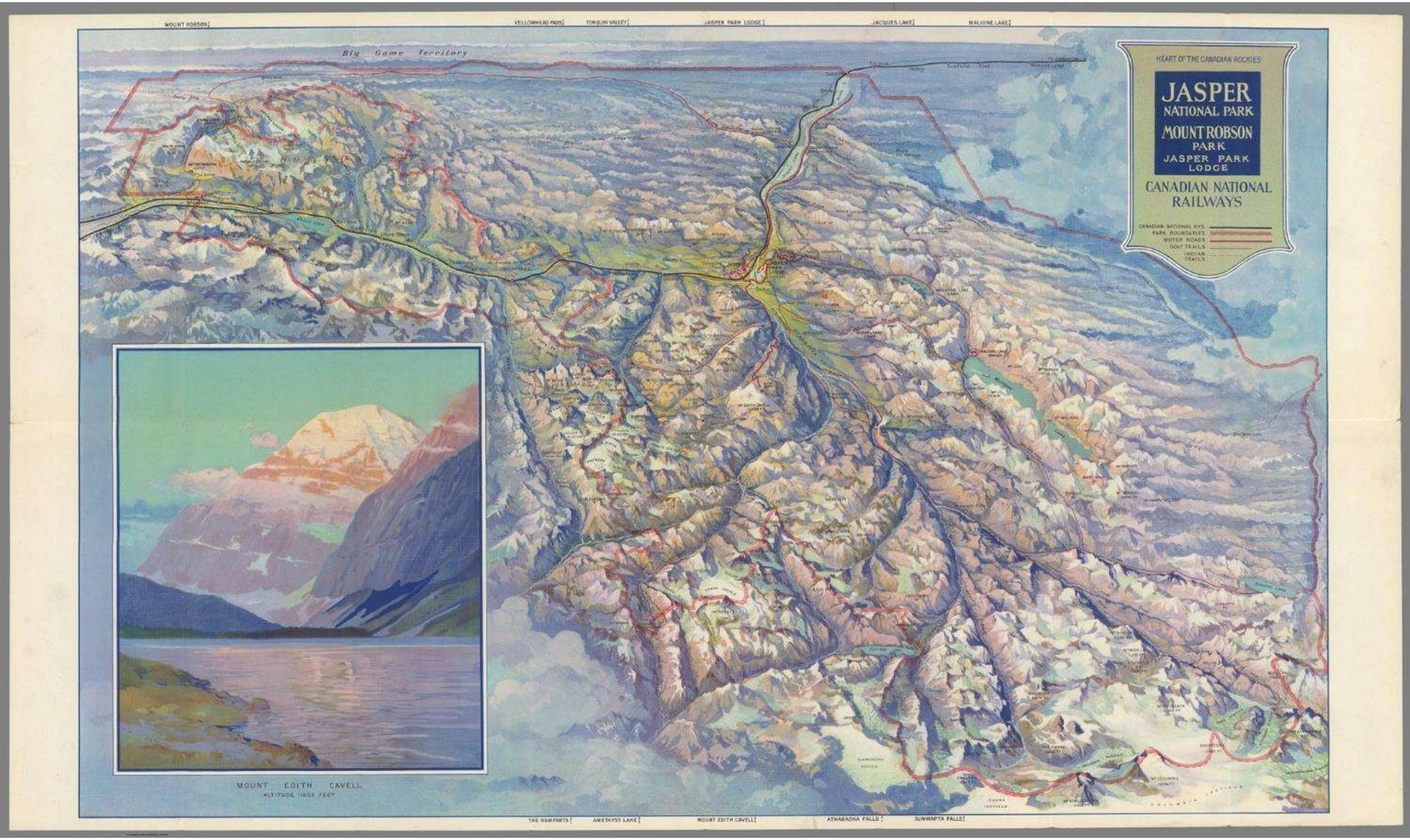
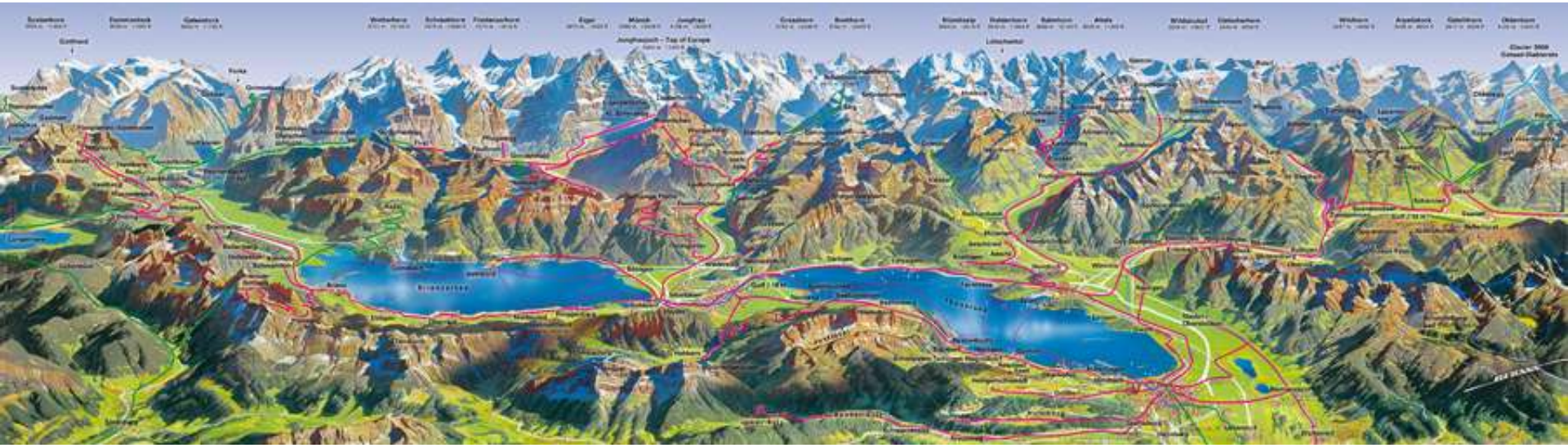
Mountain Cartography



Jasper / Mt. Robson, 1935 (Icefields Parkway first constructed 1931-41)



Interlaken, Switzerland

Mountain cartography: extra mapping challenges

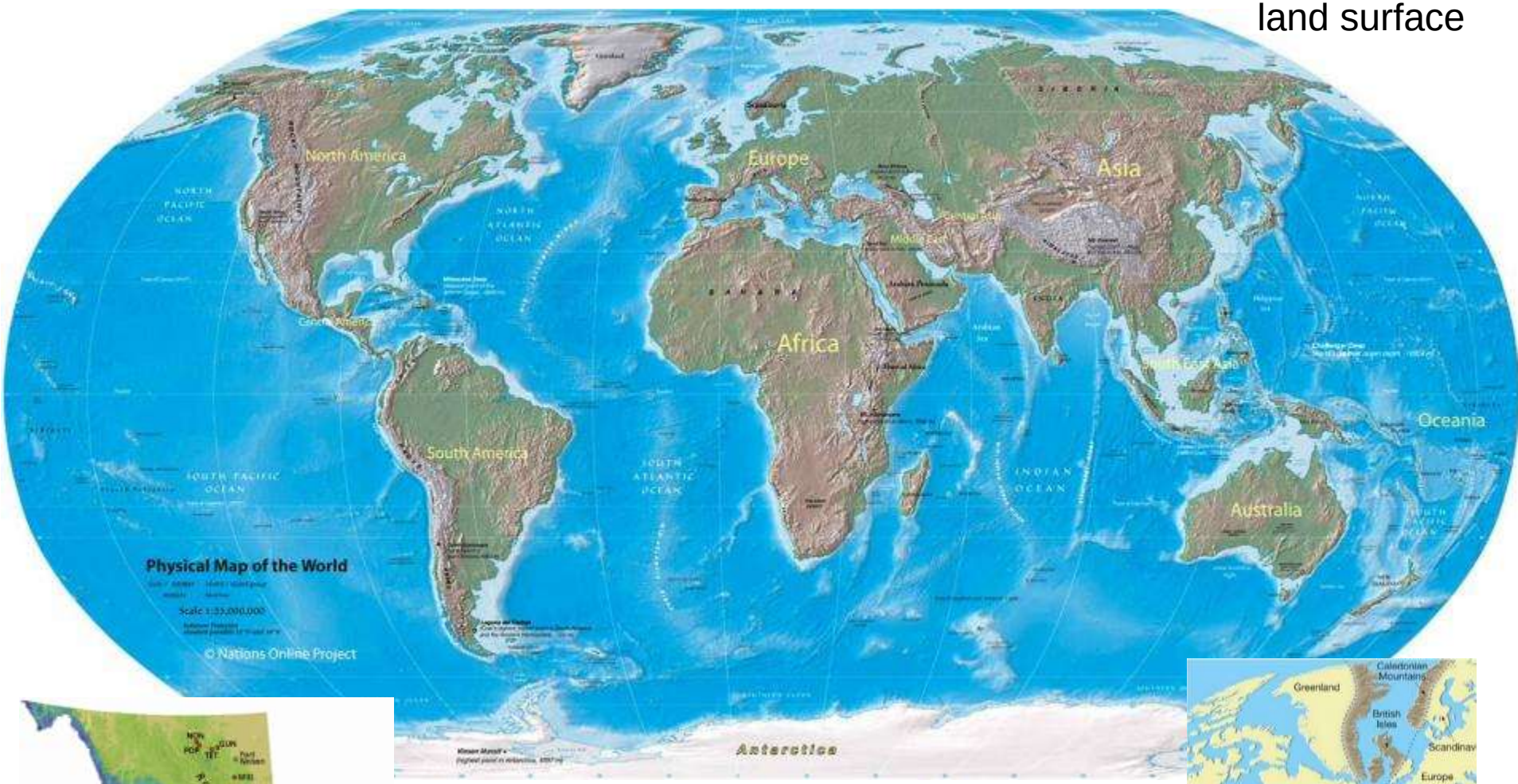
Which relief techniques to use: hachures, contours, hypsometric tints, shading ?

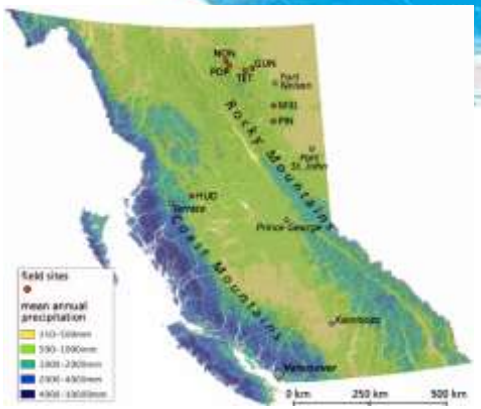
- High density of lines on steep slopes: hachures and contours
- Varying contrast of colour tint layers, and shading
- Ridges running NW-SE (equal shading / illumination)
- Issues of colour contrast with density of human features in valleys
- 2D map versus 2.5D perspective (visual versus no steady scale)

Is it a map ? …..or a 2.5D graphic

Mountains and cartography

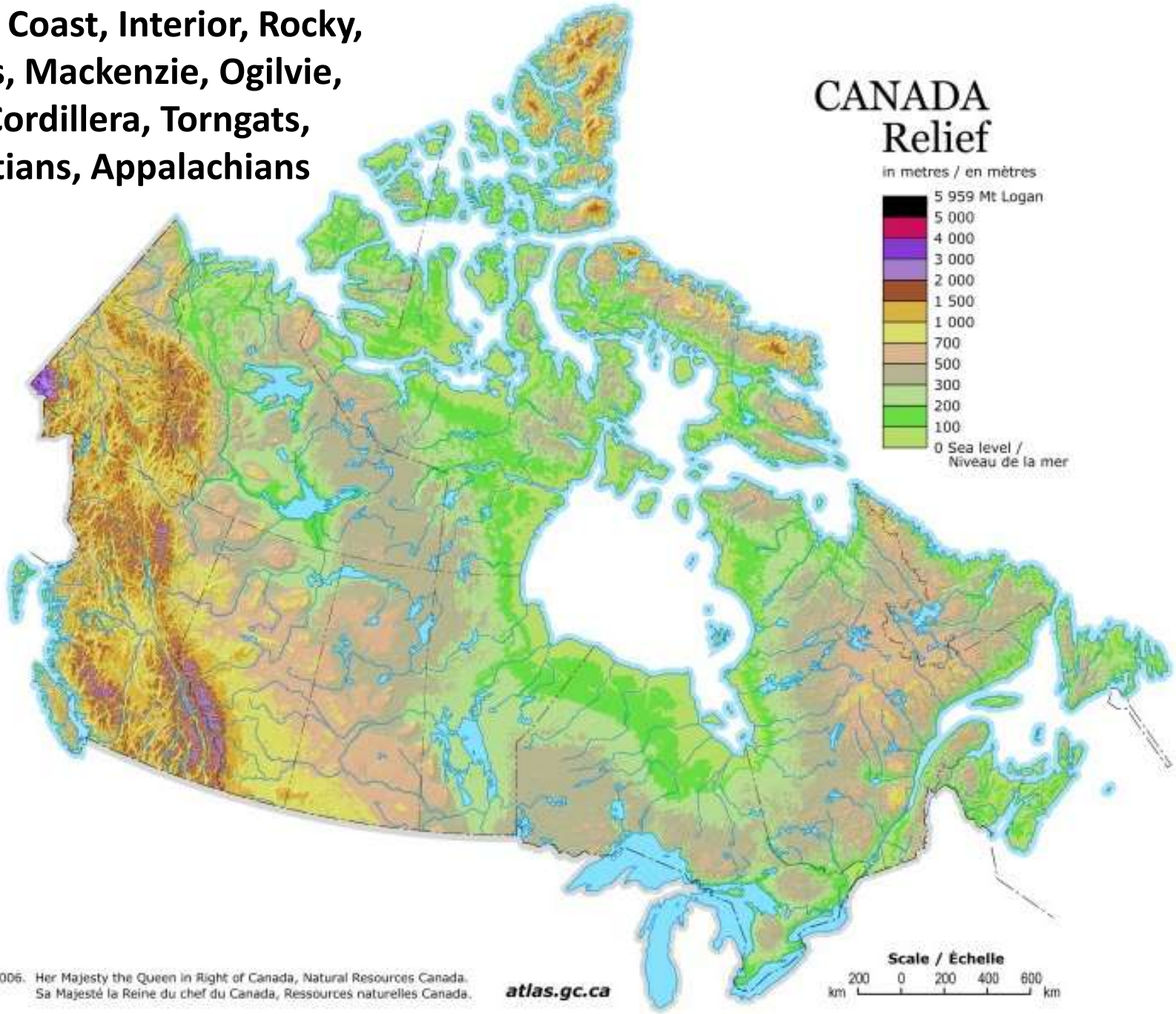
25% of world land surface



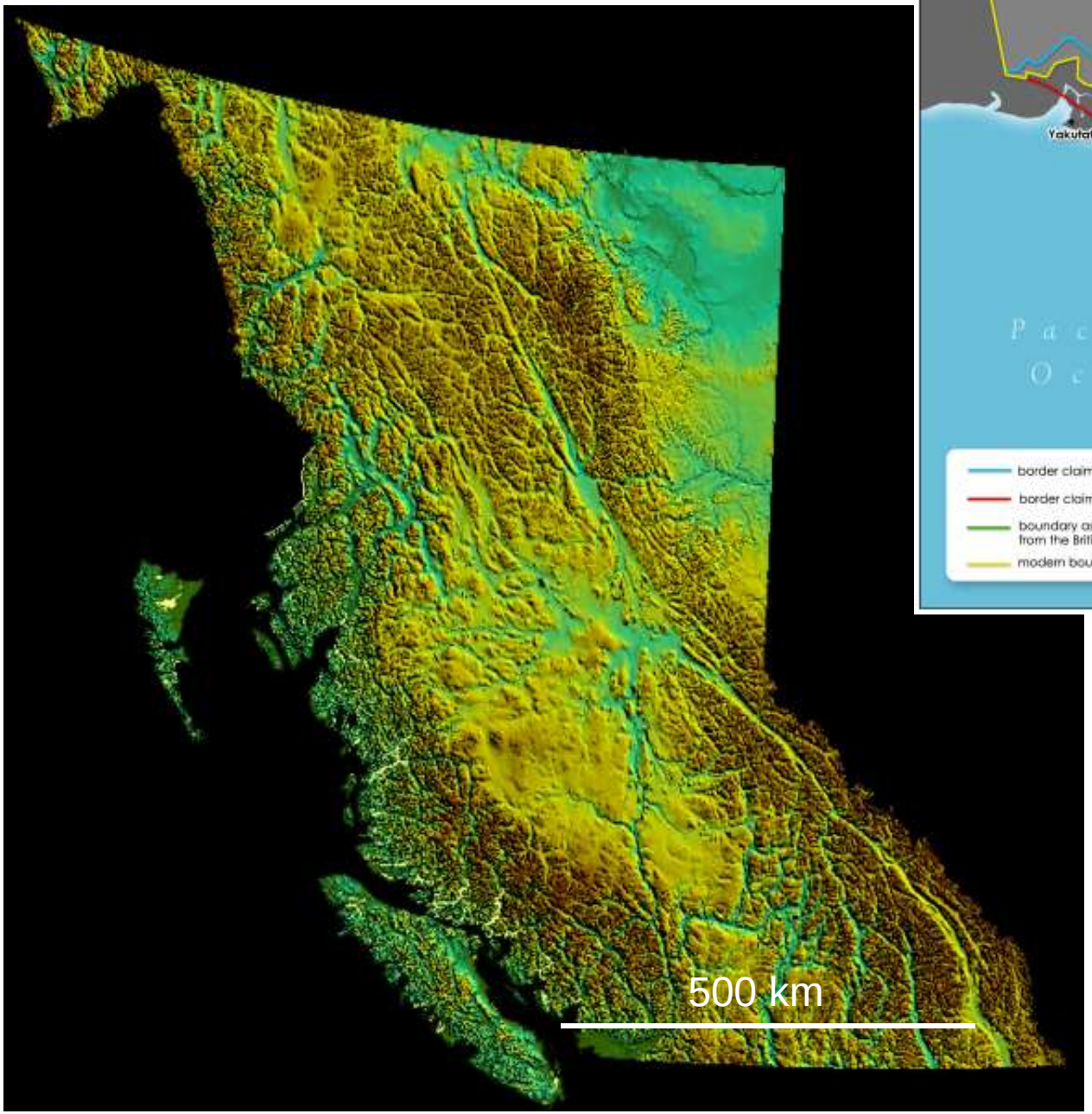


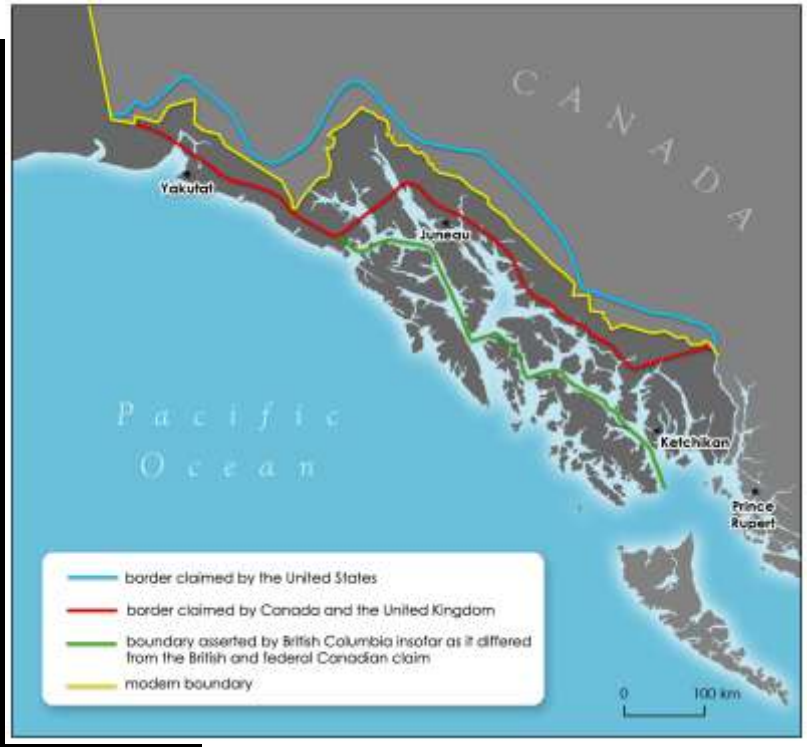
Caledonian/Acadian mountain building period ~400m yrs old Scandinavia, Scotland, Greenland, Newfoundland, Appalachians

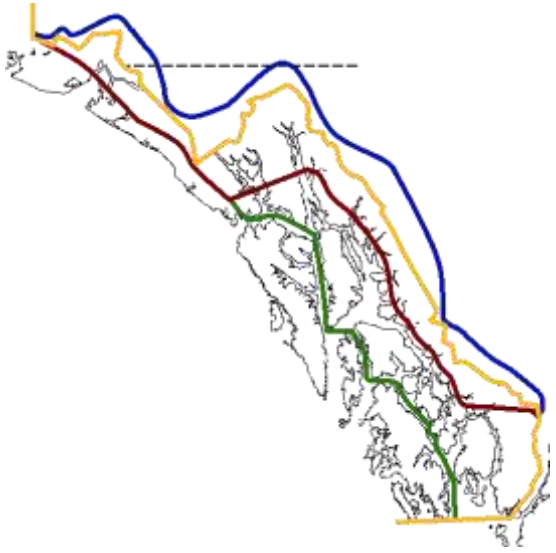
Insular, Coast, Interior, Rocky, St. Elias, Mackenzie, Ogilvie, Arctic Cordillera, Torngats, Laurentians, Appalachians



BC DEM


500 km

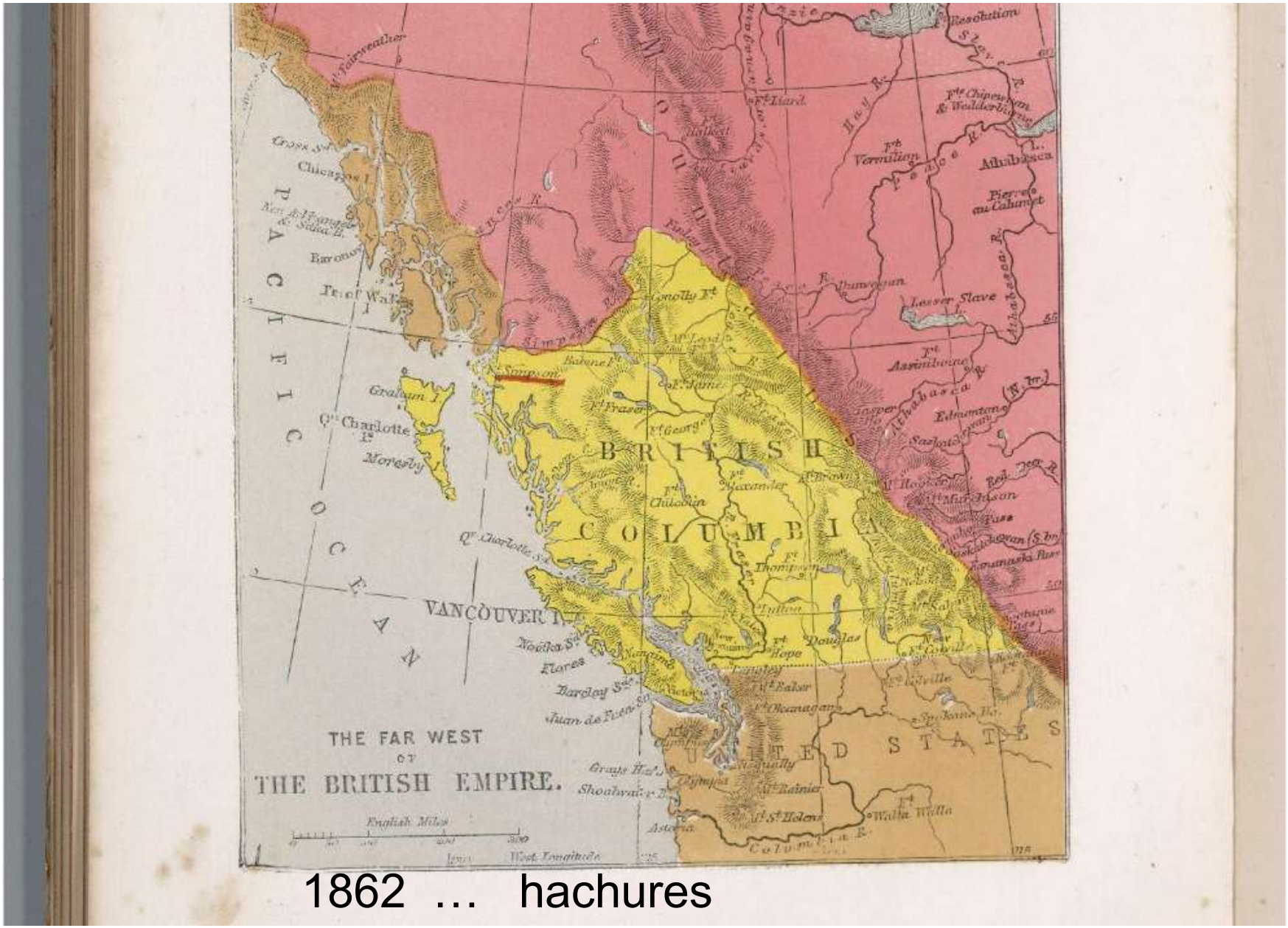

CANADA
Yakutat
Juneau
Pacific
Ocean
Ketchikan
Prince Rupert
border claimed by the United States
border claimed by Canada and the United Kingdom
boundary asserted by British Columbia insofar as it differed from the British and federal Canadian claim
modern boundary
0
100 km



Timeline of mountain mapping in Canada

- Early mapping pre-1875
- Photo-topography in Canada 1875-1950
- Federal mapping (air photos) 1950 -1995
- Private sector (digital mapping) 1995 –> present

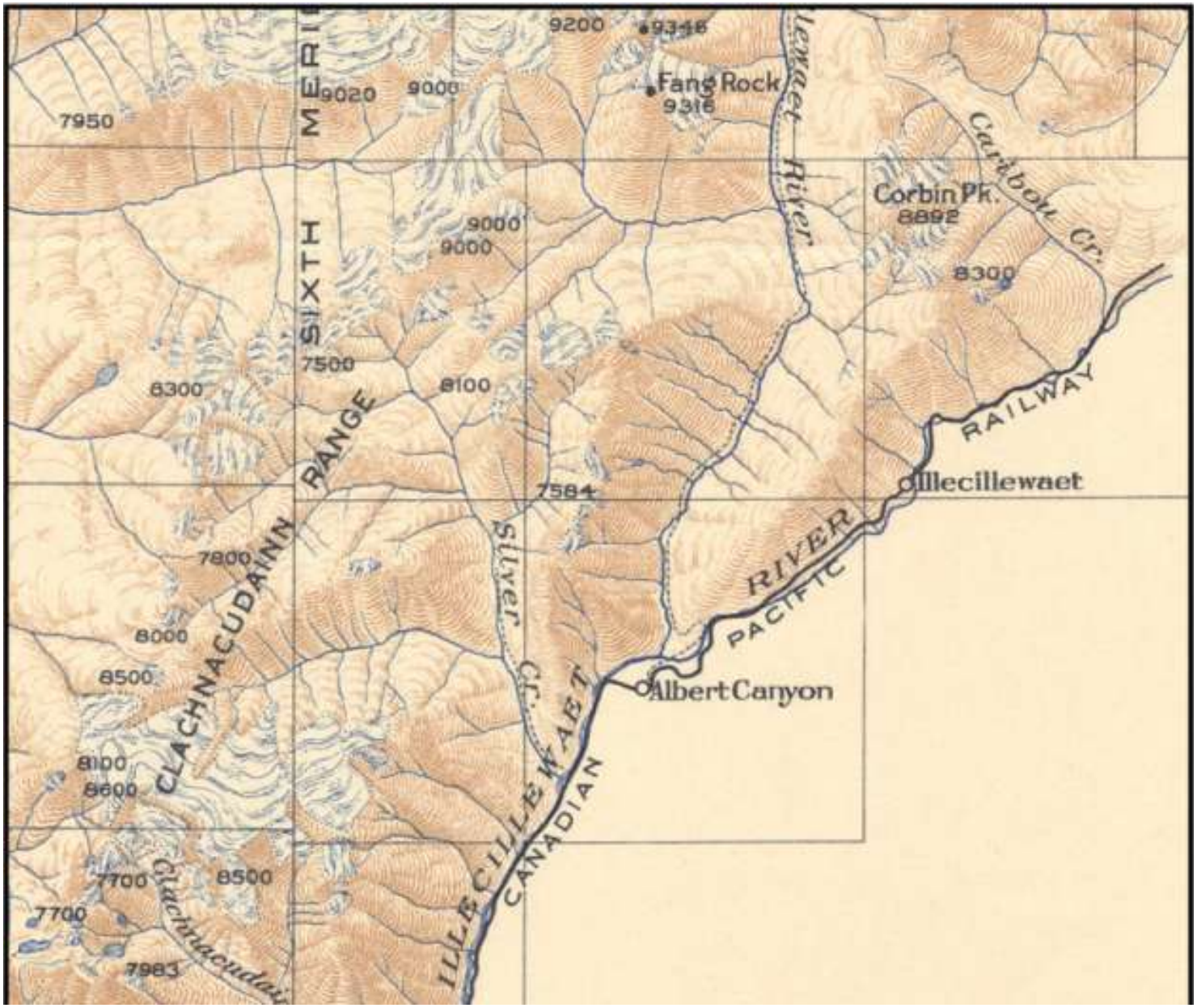
Brief history of mountain cartography: **Early mapping pre-1875**



1862 … hachures

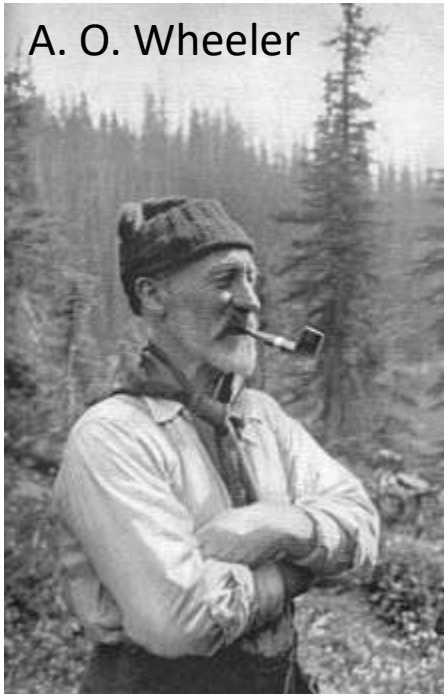
1911 hachures, BC

Selkirks 1885, part of railway map – luring tourists from Europe



2. Early mapping: Photo-topography, 1885-1950

A technique introduced from France by the surveyor-general (Edouard Deville). Surveyors would place the camera on a mountain peak, point the lens at the horizon and take panoramic shots of the surrounding peaks. Surveyors took photos in the short summer season, then would complete their calculations and mapping in their offices during the winter. **This allowed larger areas to be surveyed more accurately**, in less time, and at one-third the cost of conventional surveying.
It later gave way to aerial photogrammetry.



A. O. Wheeler

← Founder: Alpine Club of Canada

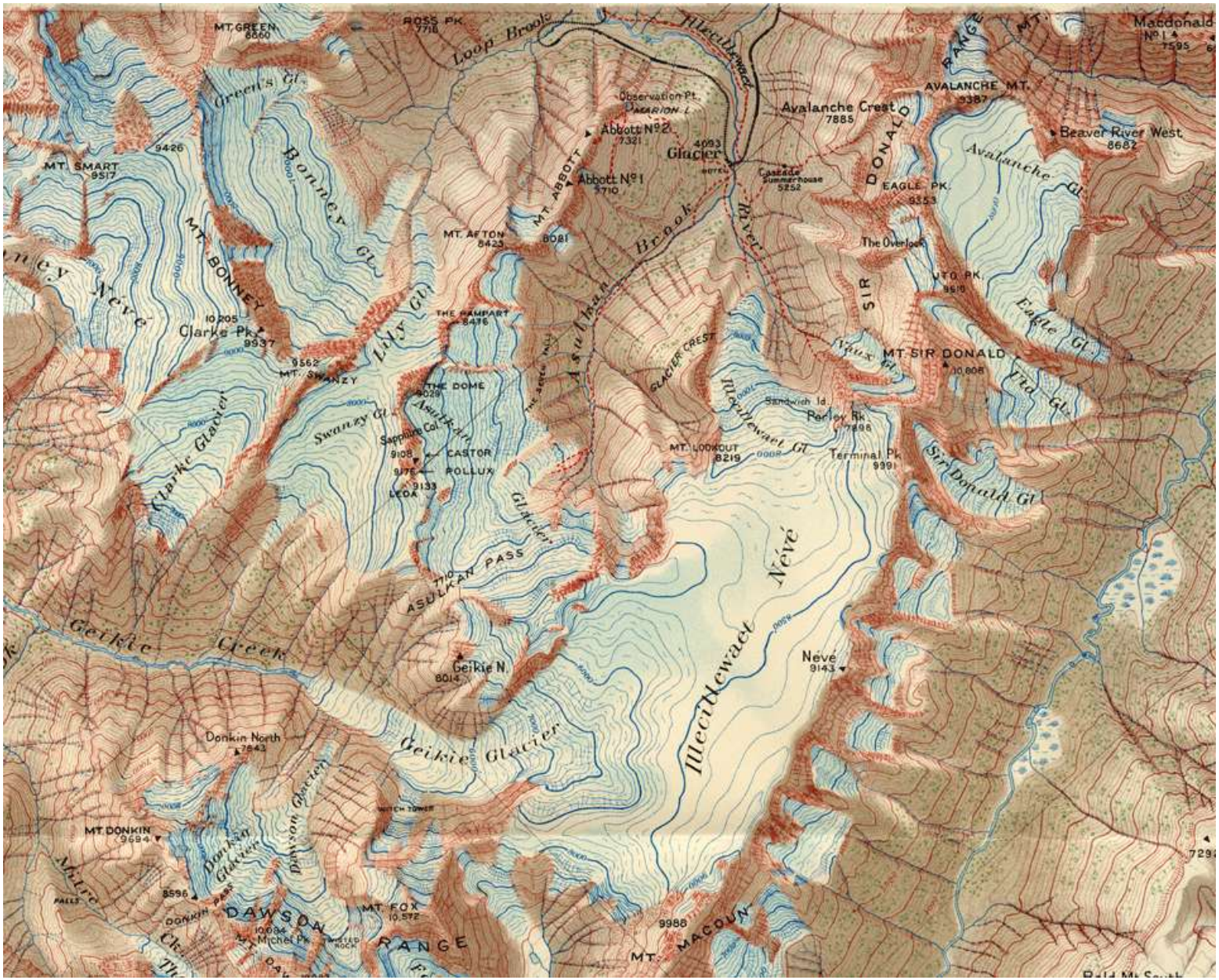
Early full colour map: Canadian Rocky Mountain, 1890

Mapped to entice climbers from Europe (20 maps in the series, Banff to Lake Louise)

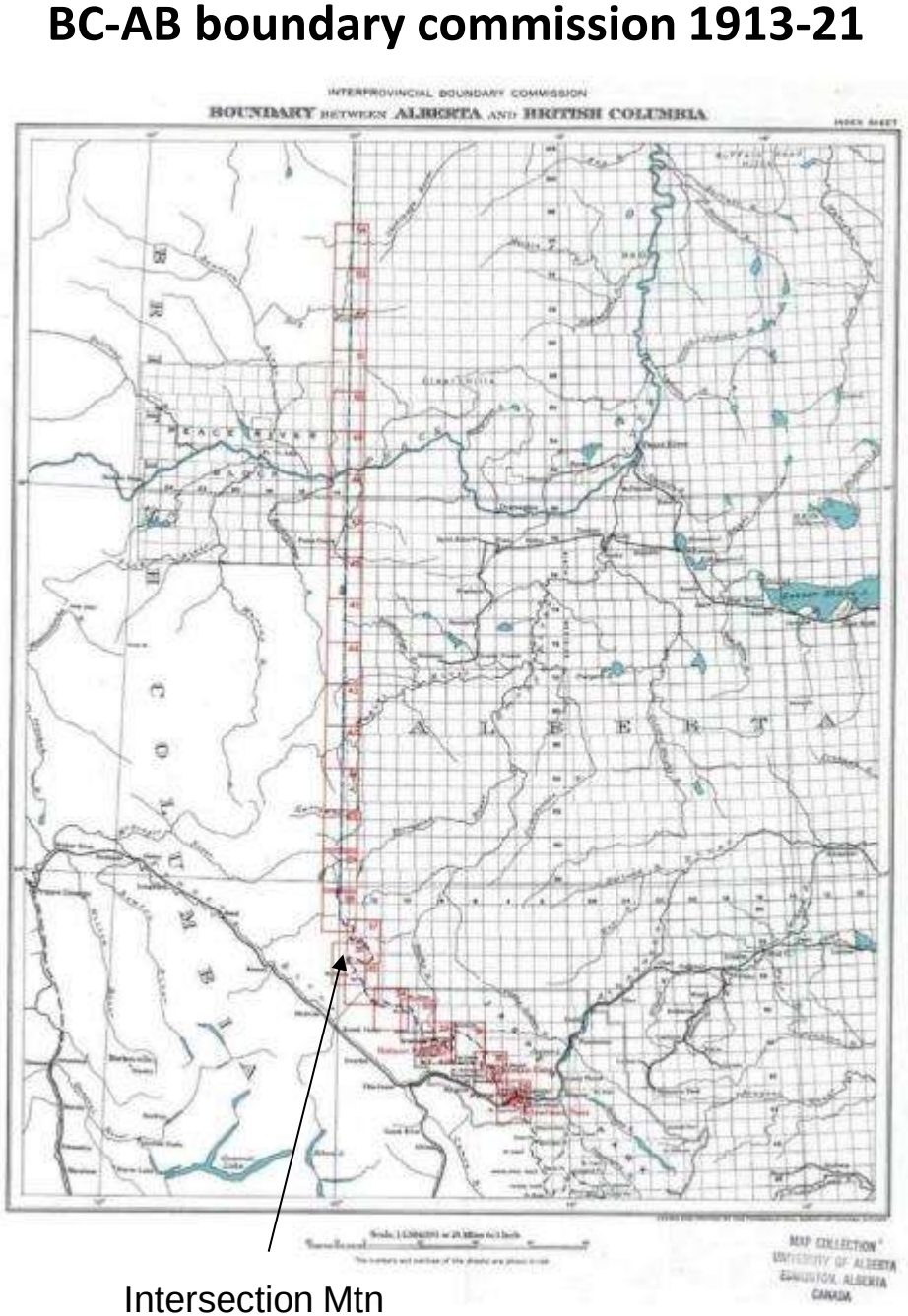
Figure 3: Forty-Mile Creek 1890. Topographical Surveys Branch, Department of the Interior, Ottawa. Triangulation by W.S. Drewry, D.L.S. Topography by J.J. McArthur, D.L.S. 1:40,000

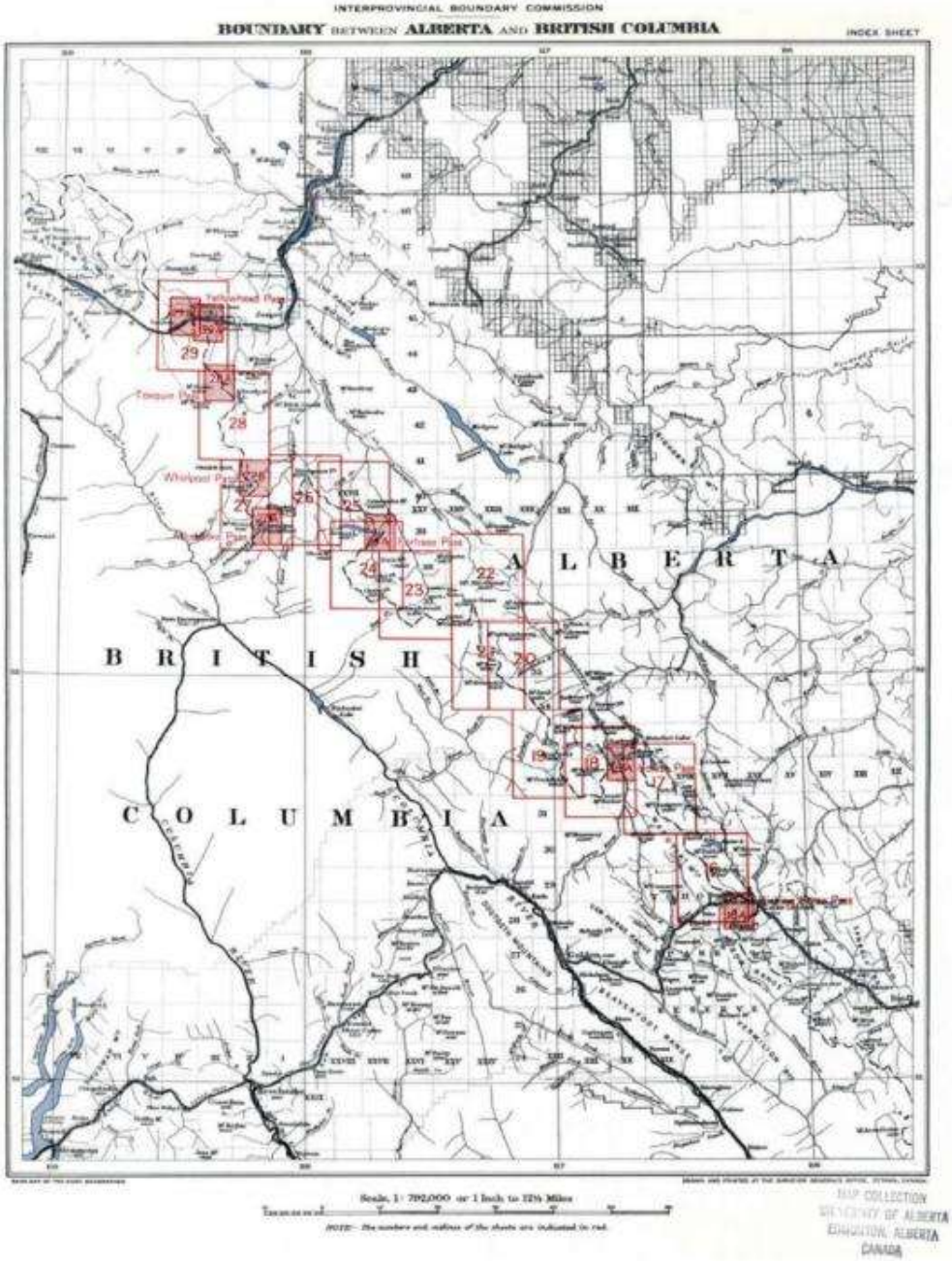
https://library.mcmaster.ca/rocky-mountain-photo-topographic-survey-maps-1887

Mapping before aerial photography: Selkirk Range, 1906 (A.O. Wheeler)
UNBC special collections, contours 100’



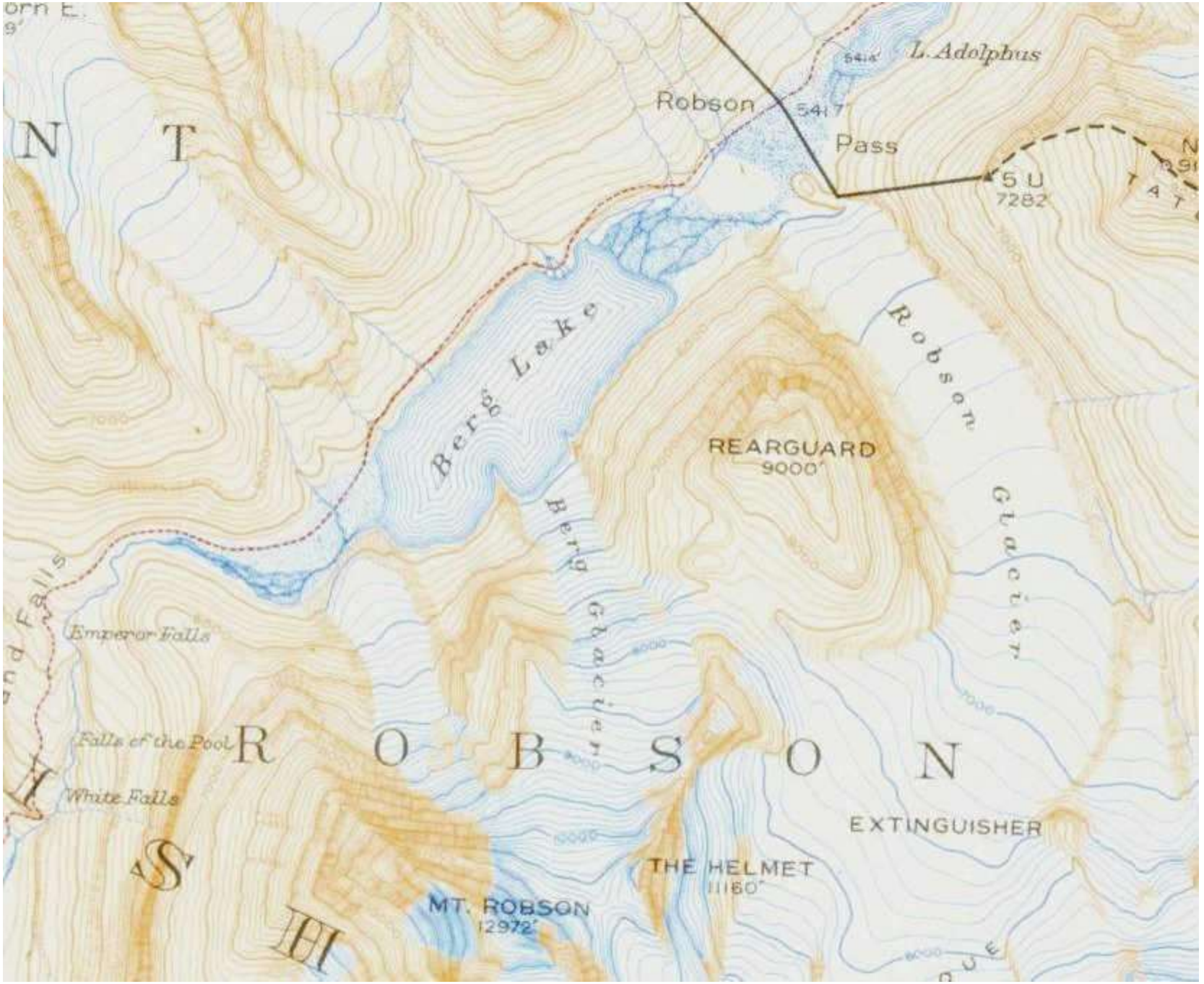
BC-AB boundary commission 1913-21





Intersection Mtn

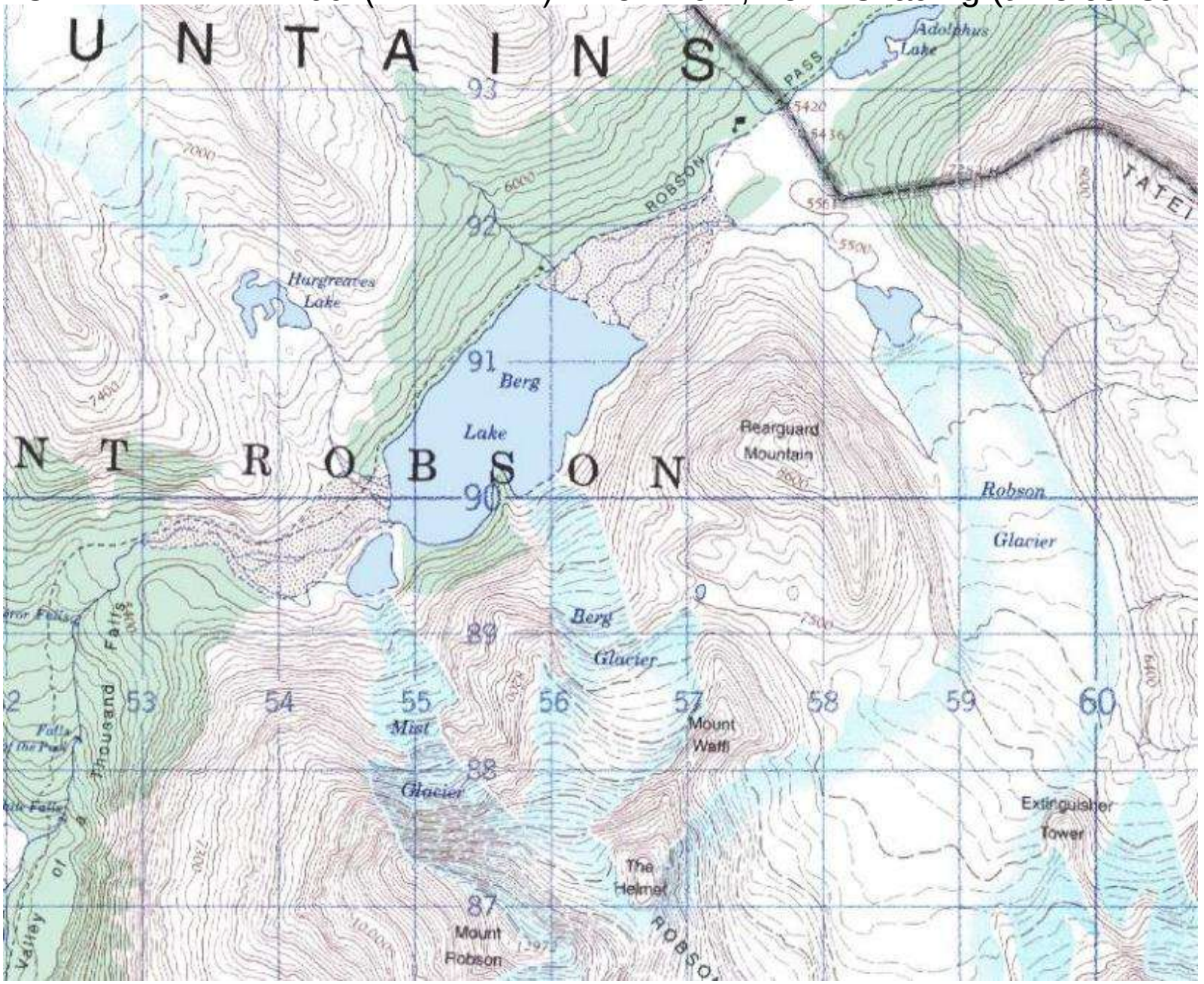
sample map from AB-BC boundary commission map series: Mt. Robson, 1923



1975 NTS map sheet

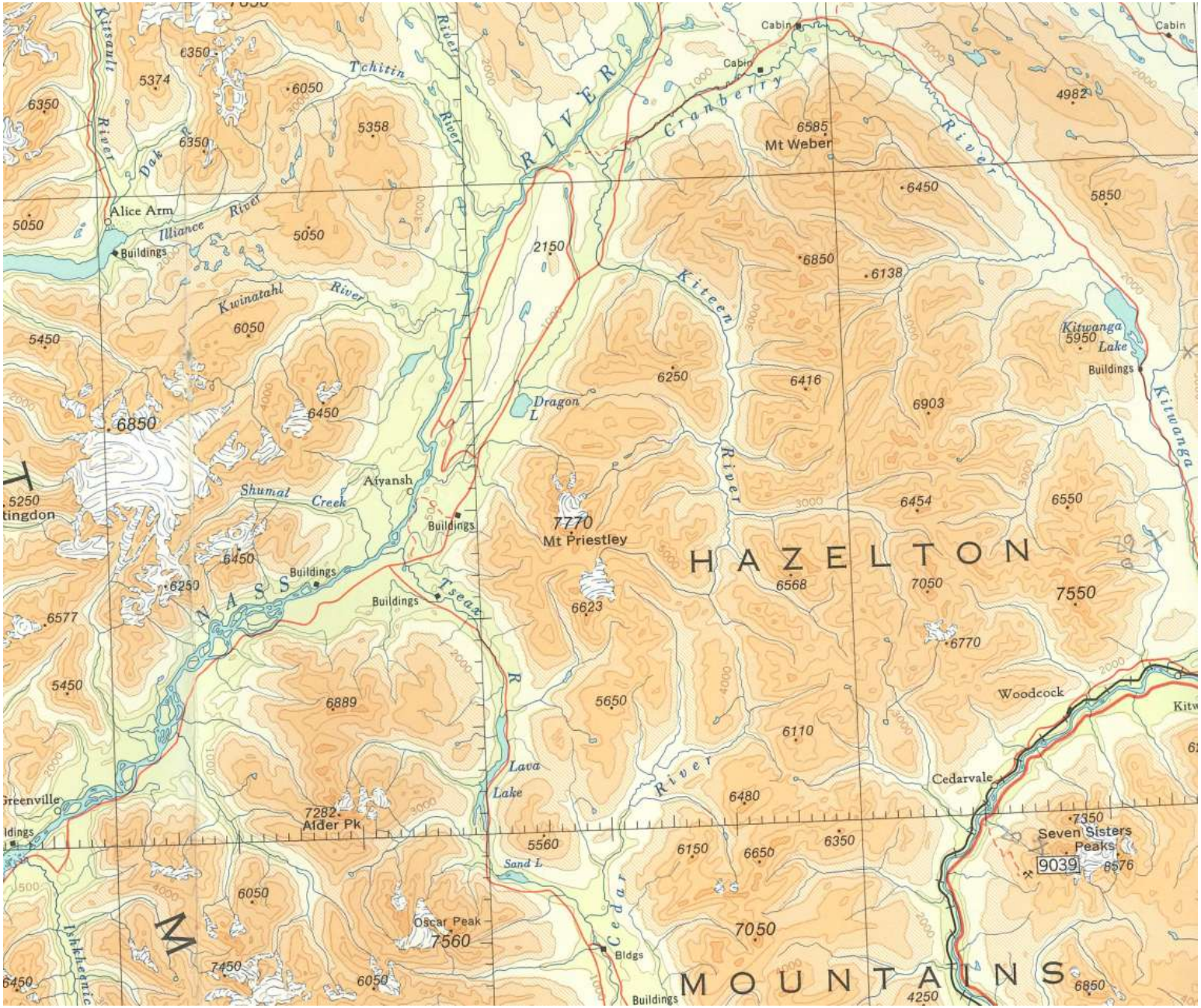
3. Post-war mapping from aerial photography, 1945-95 1:50,000

Contour interval 100’ (mountains) – now 40m, no hillshading (time consuming)

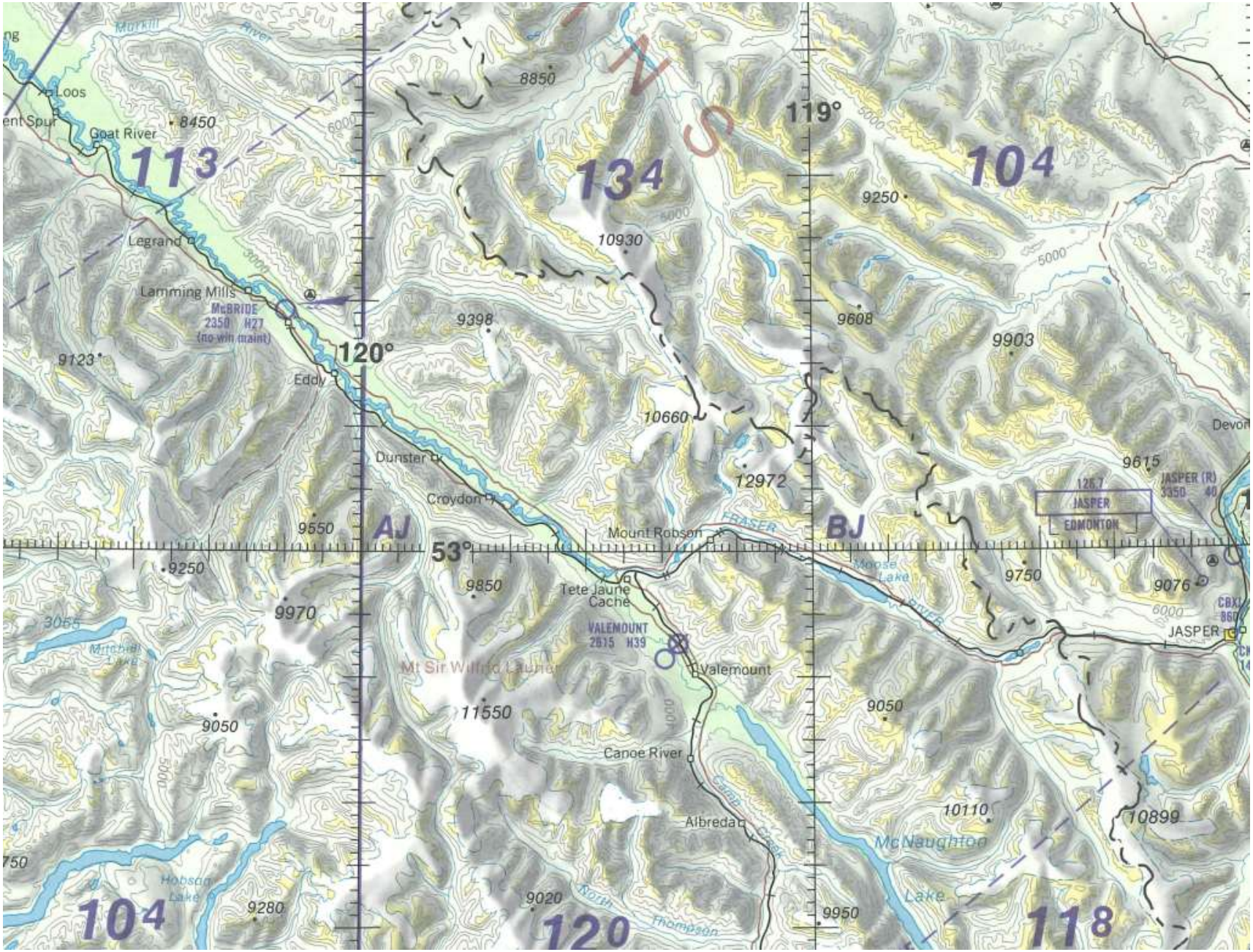


Robson Glacier, Rearguard Mountain and Berg Glacier / Lake – August 2011

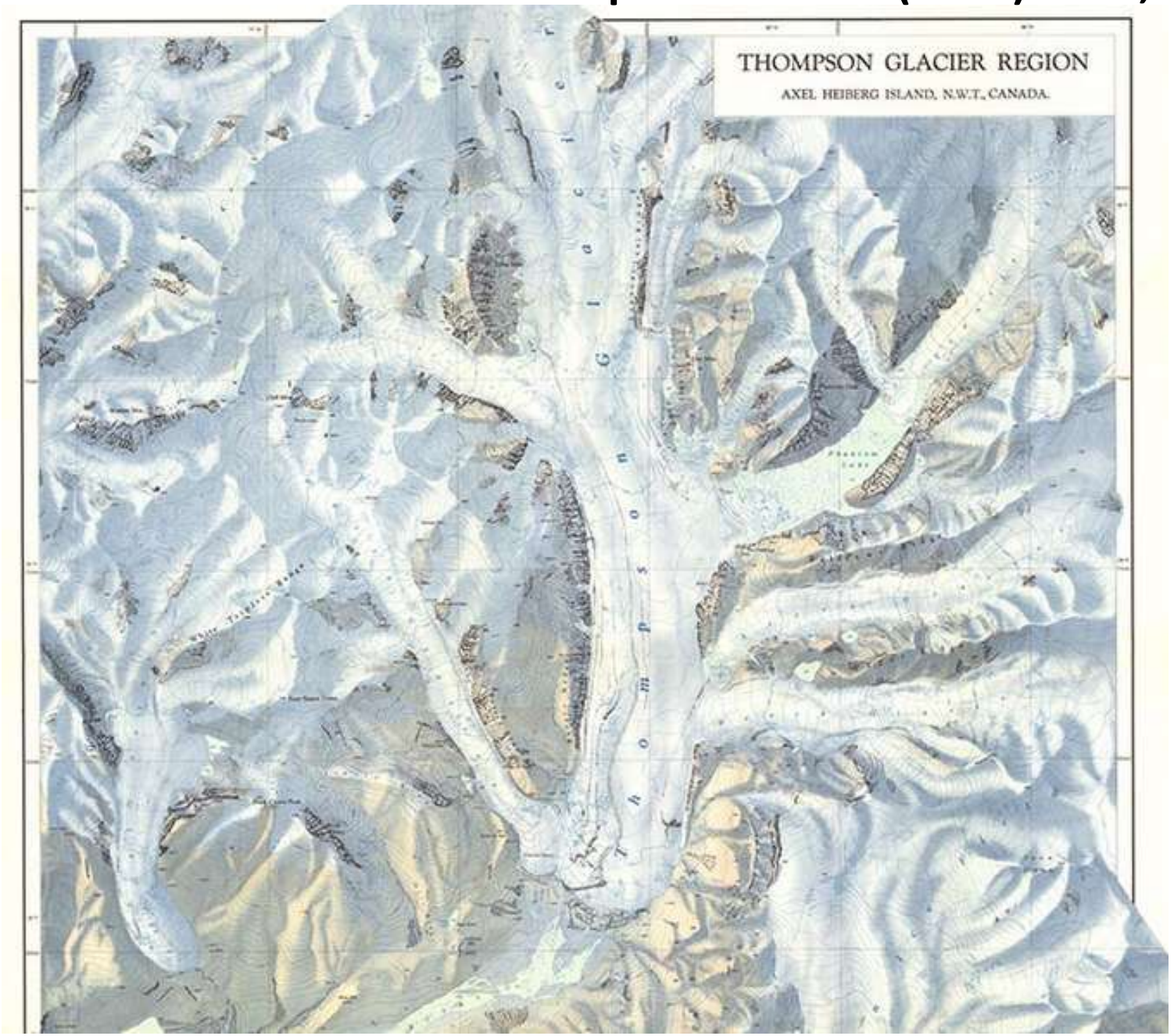
Aeronautical chart, 1:500,000 1973 - tints, no hillshading



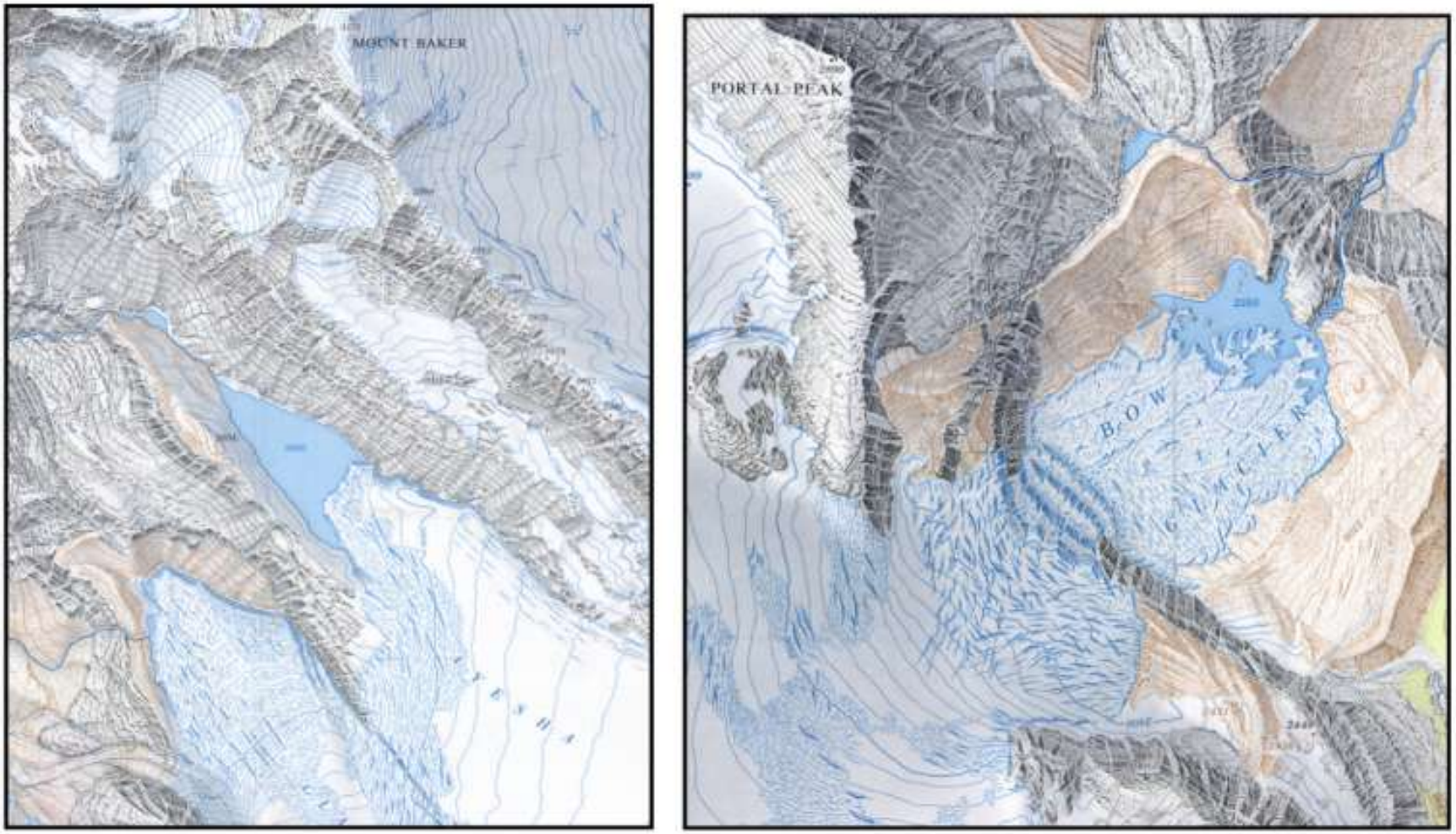
Aeronautical chart, 1:1,000,000 1998 (less updating now with GPS navigation)



Manual shaded relief for select maps 1960s-80s (1962) 1:50,000

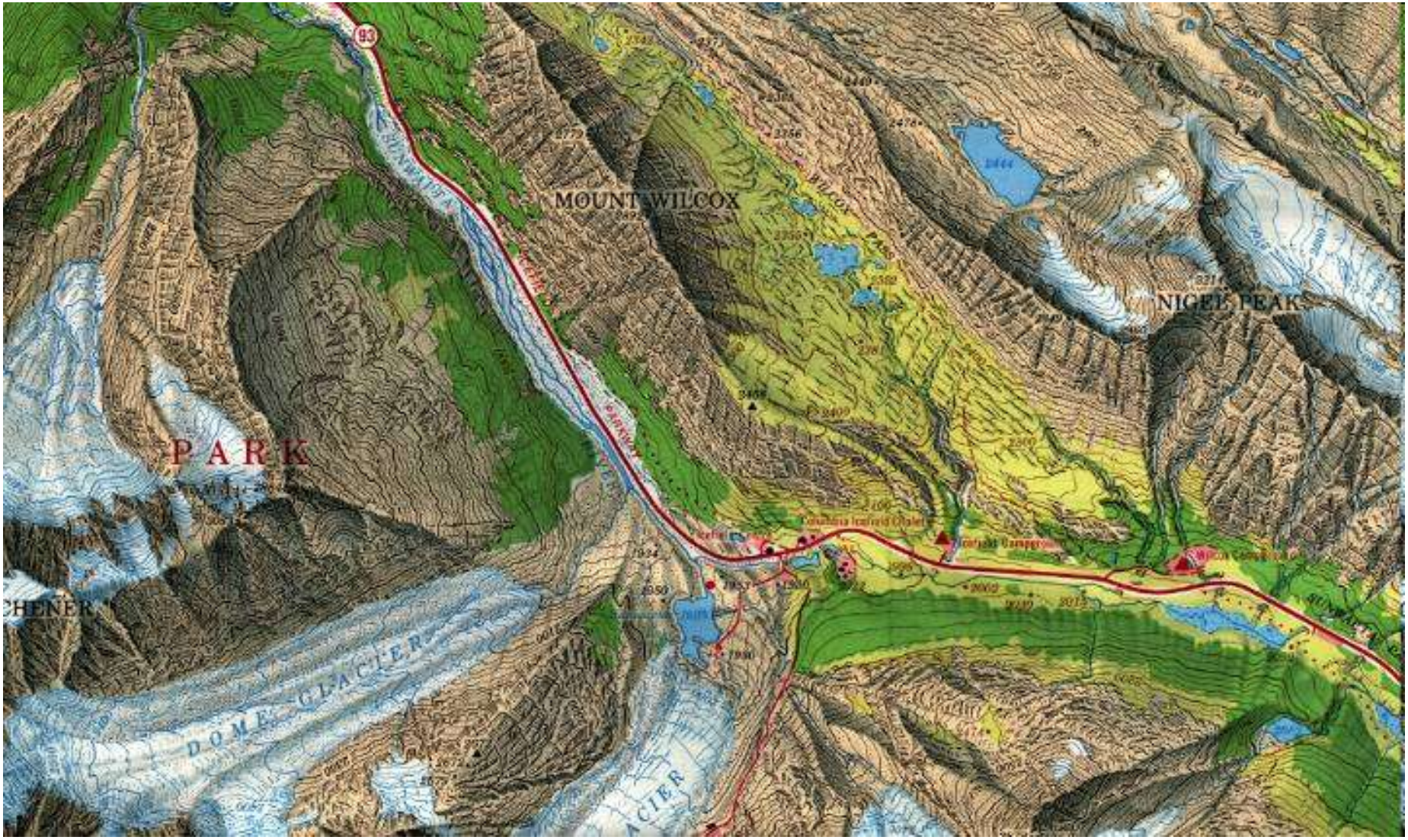


Swiss cartographers 'imported' to train Canadian cartographers on the 'swiss' method incorporating rock hachures with contours and hillshading - 1975



gure 15. Ayesha (left) and Bow Glacier (right) from Peyto Glacier Map – New Edition. 1:10,000

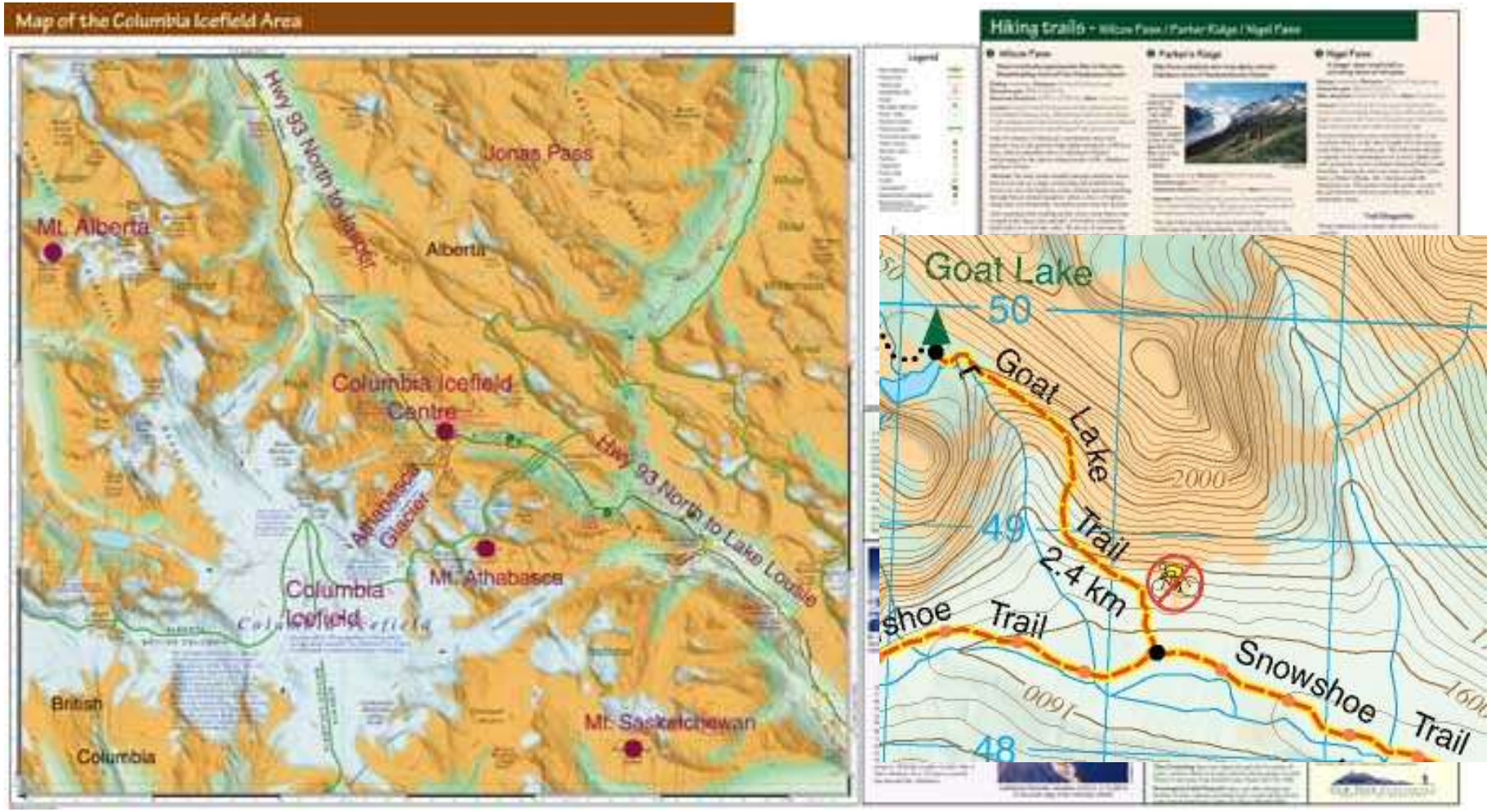
Columbia Icefield, 1981 … contours, shading, rock hachures, 1:40,000



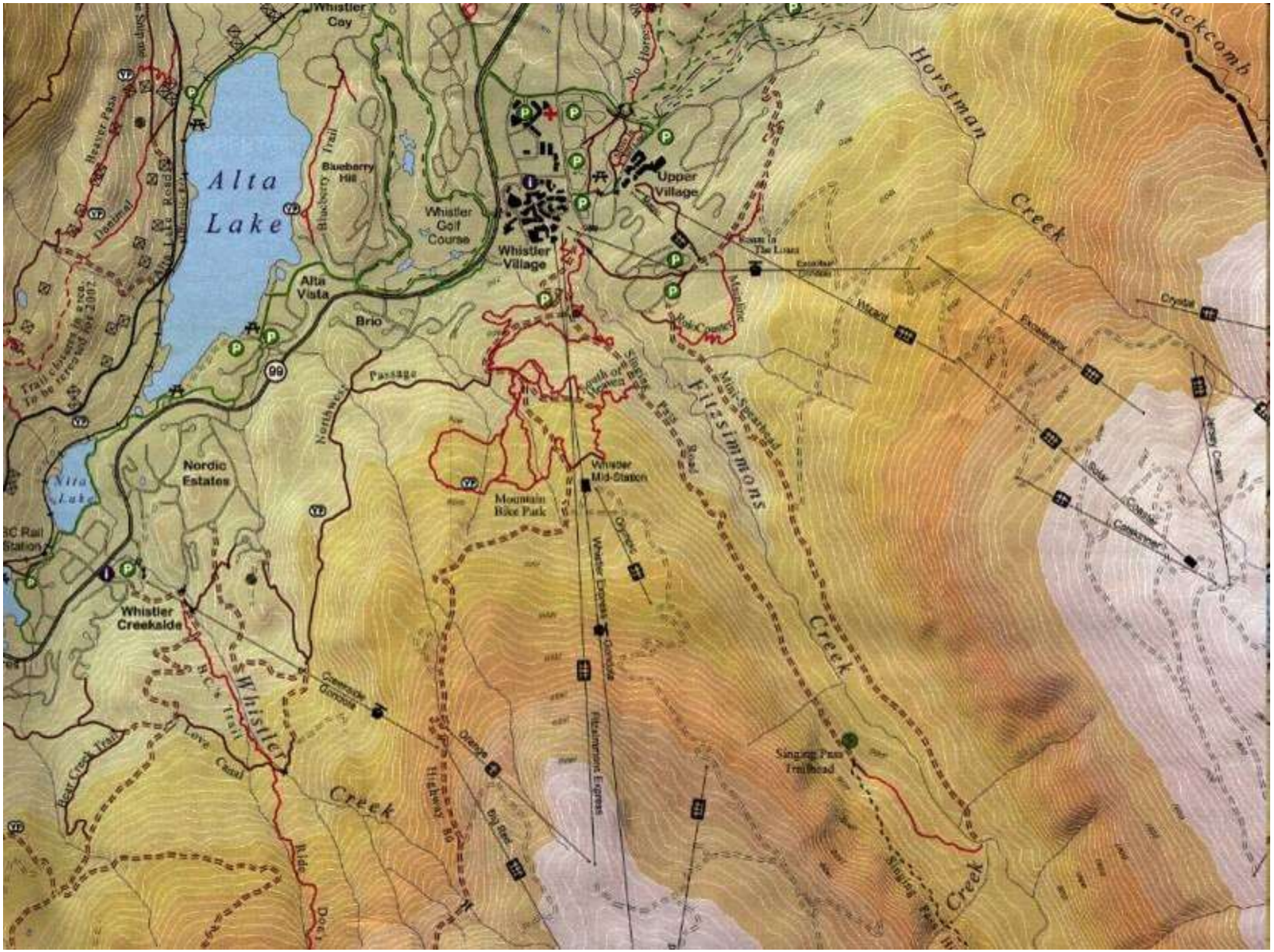
4: 1995->: government map-making was left to the private sector

Federal data distributed, e.g. Gemtrek maps (Calgary): http://www.gemtrek.c

Hill shading feasible again from DEMs – here with unusual light source from the SW ..

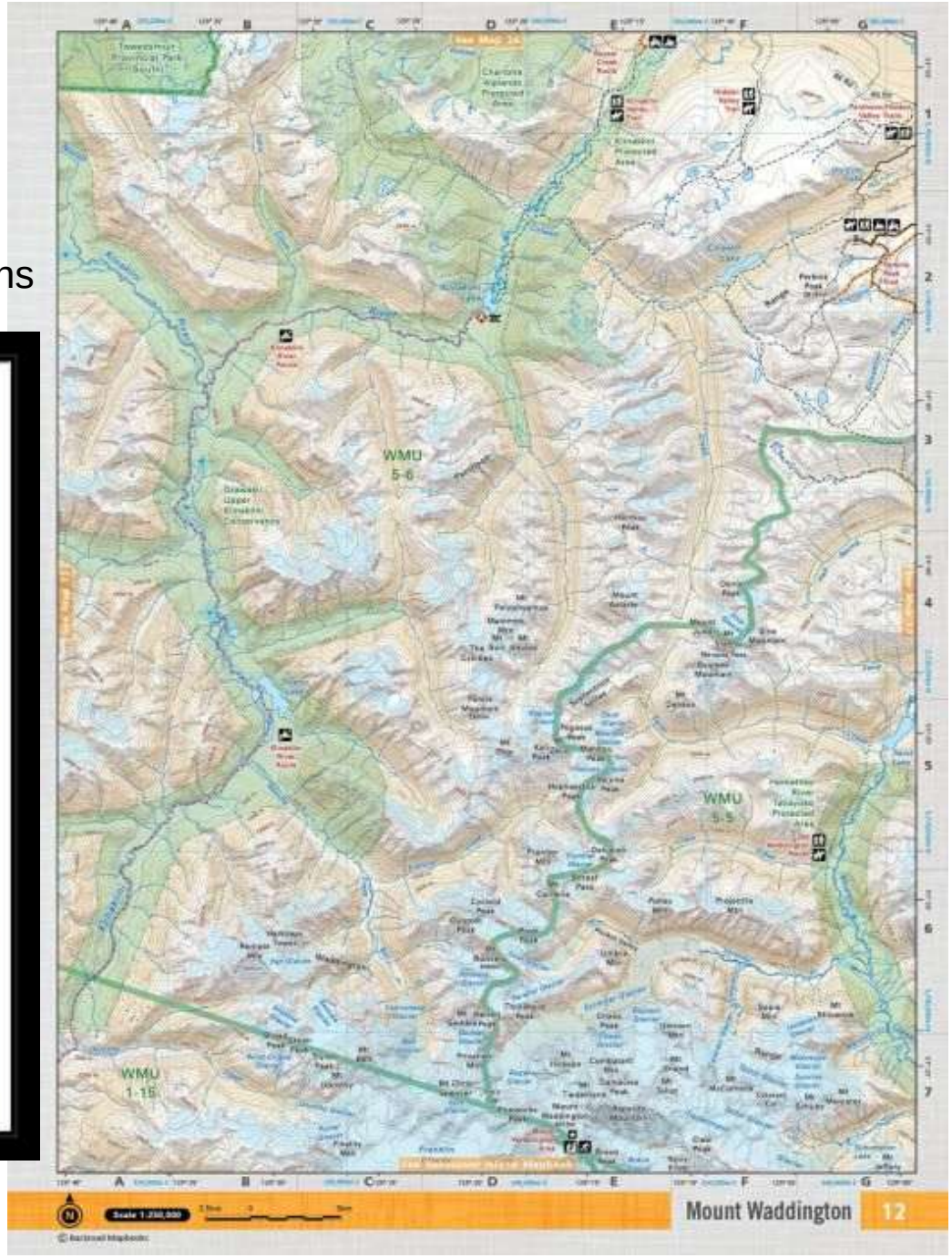


BC ‘TRIM’ data – available ~1995 ($500 / map sheet) e.g recreational mapping



Mt. Waddington
- highest mountain entirely in BC

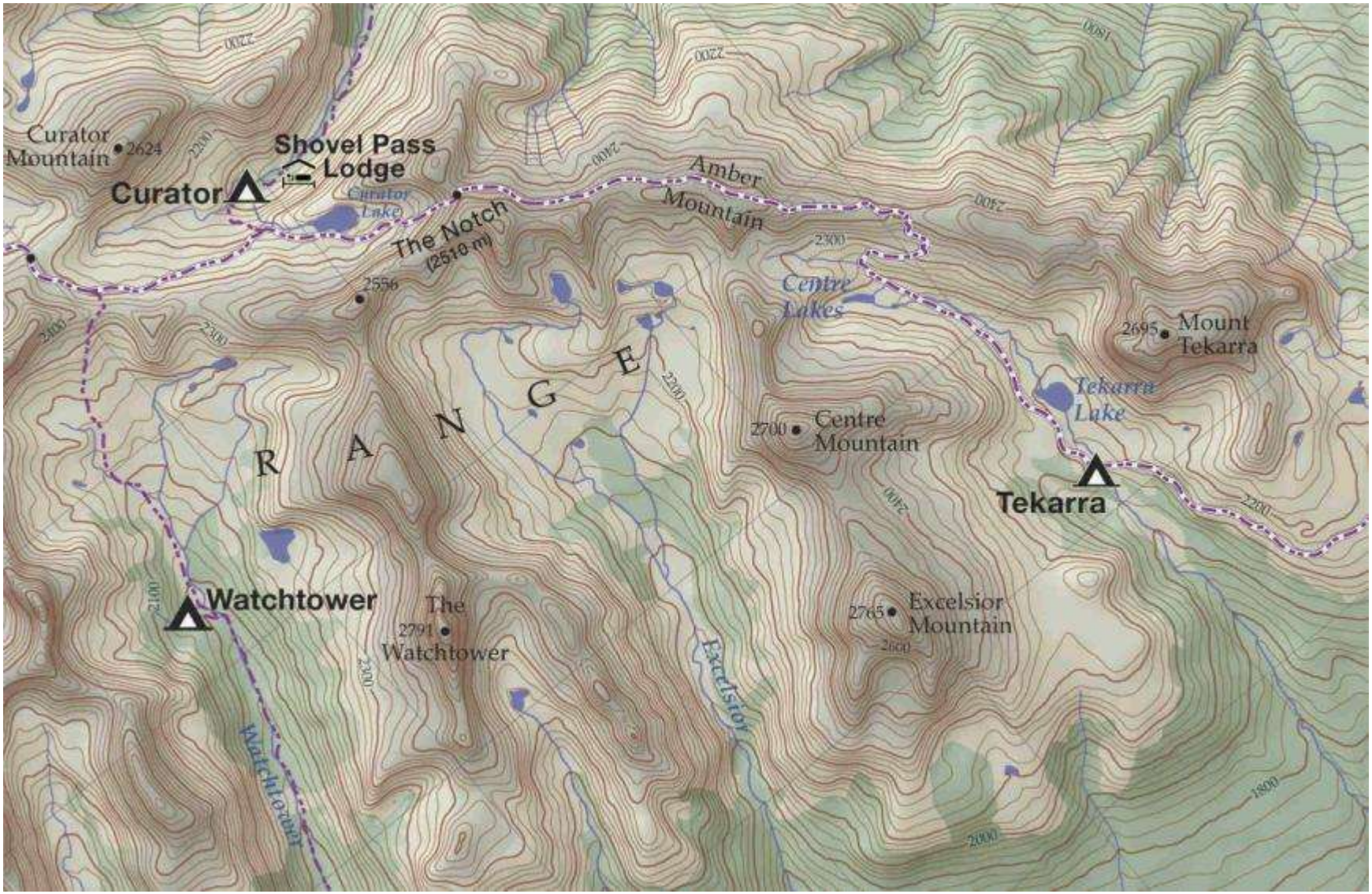
Some striping in the BC TRIM DEM
on icefields – photos too bright to fix elevations



Marcel Morin, Timberline consulting

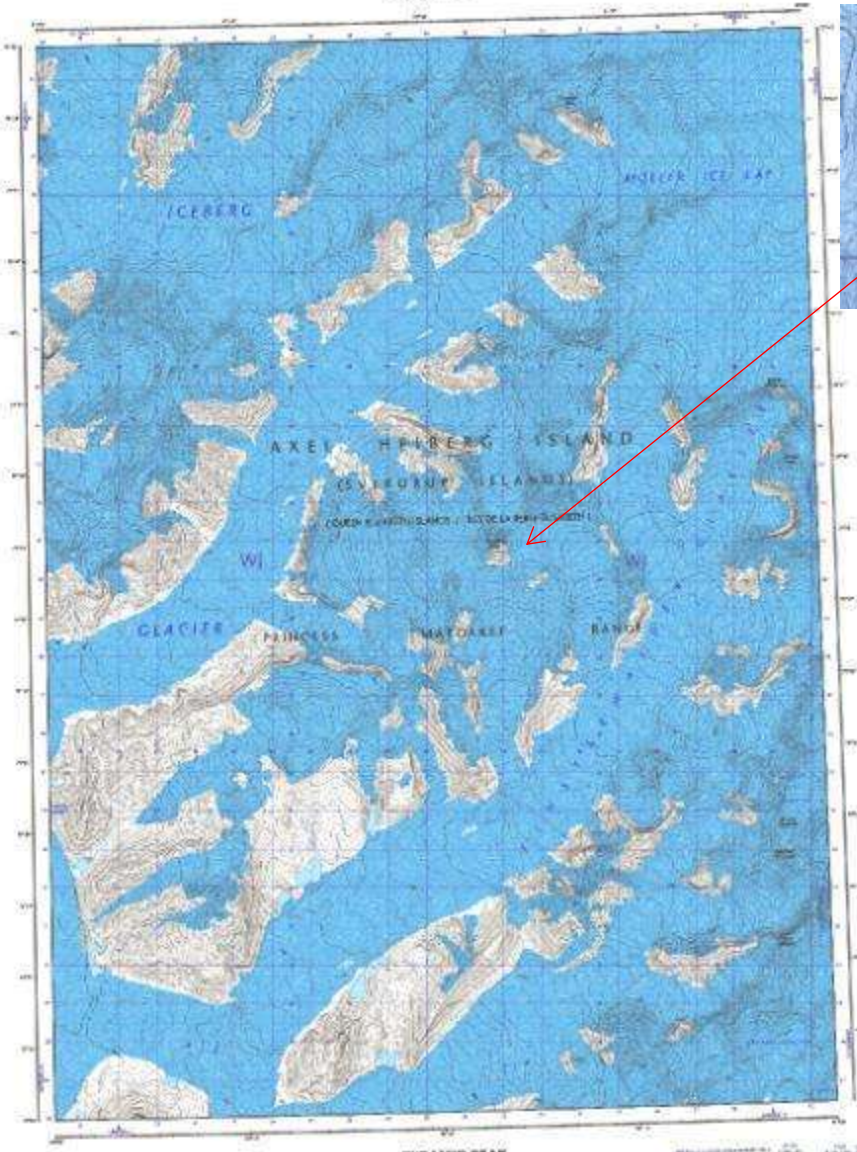
Bugaboos - Marcel Morin: Lost Art Cartography

Skyline trail, Jasper National Park, 2013 (Mike Mitchell)



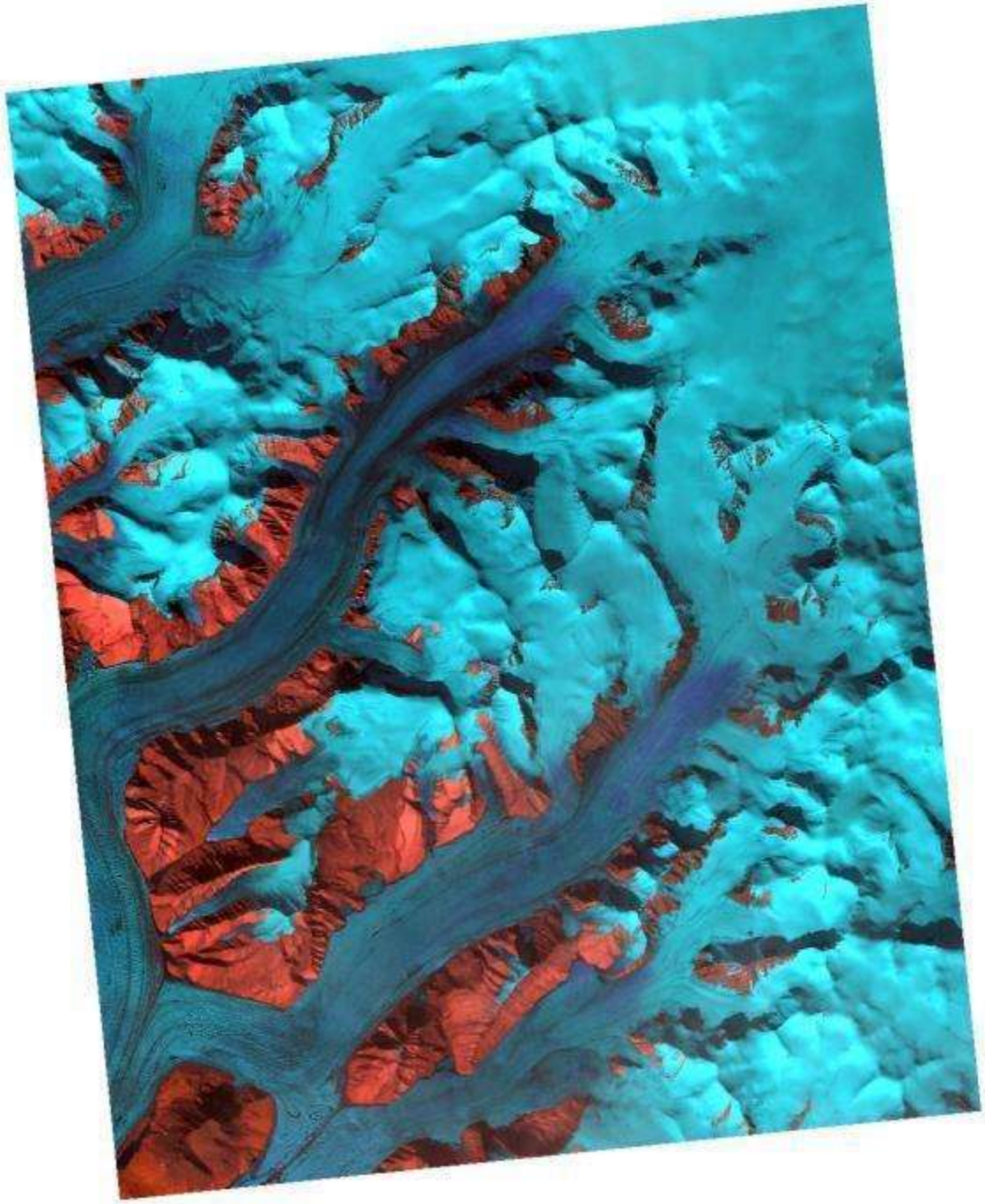
Area 1: Pyramid Peak, Axel Heiberg Island

Our final map sheet to complete the 1:50,000 topo series: 13,350 maps

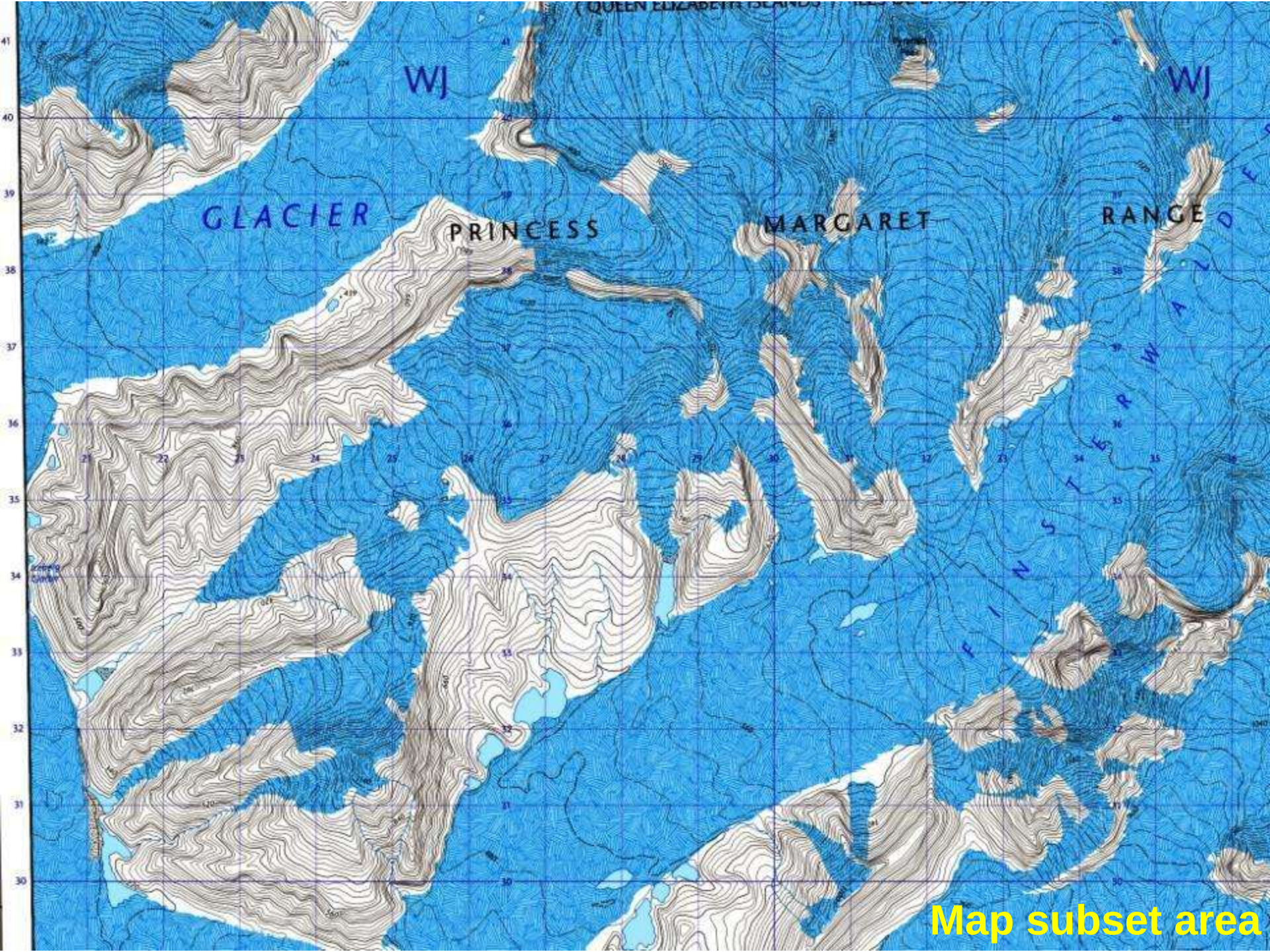


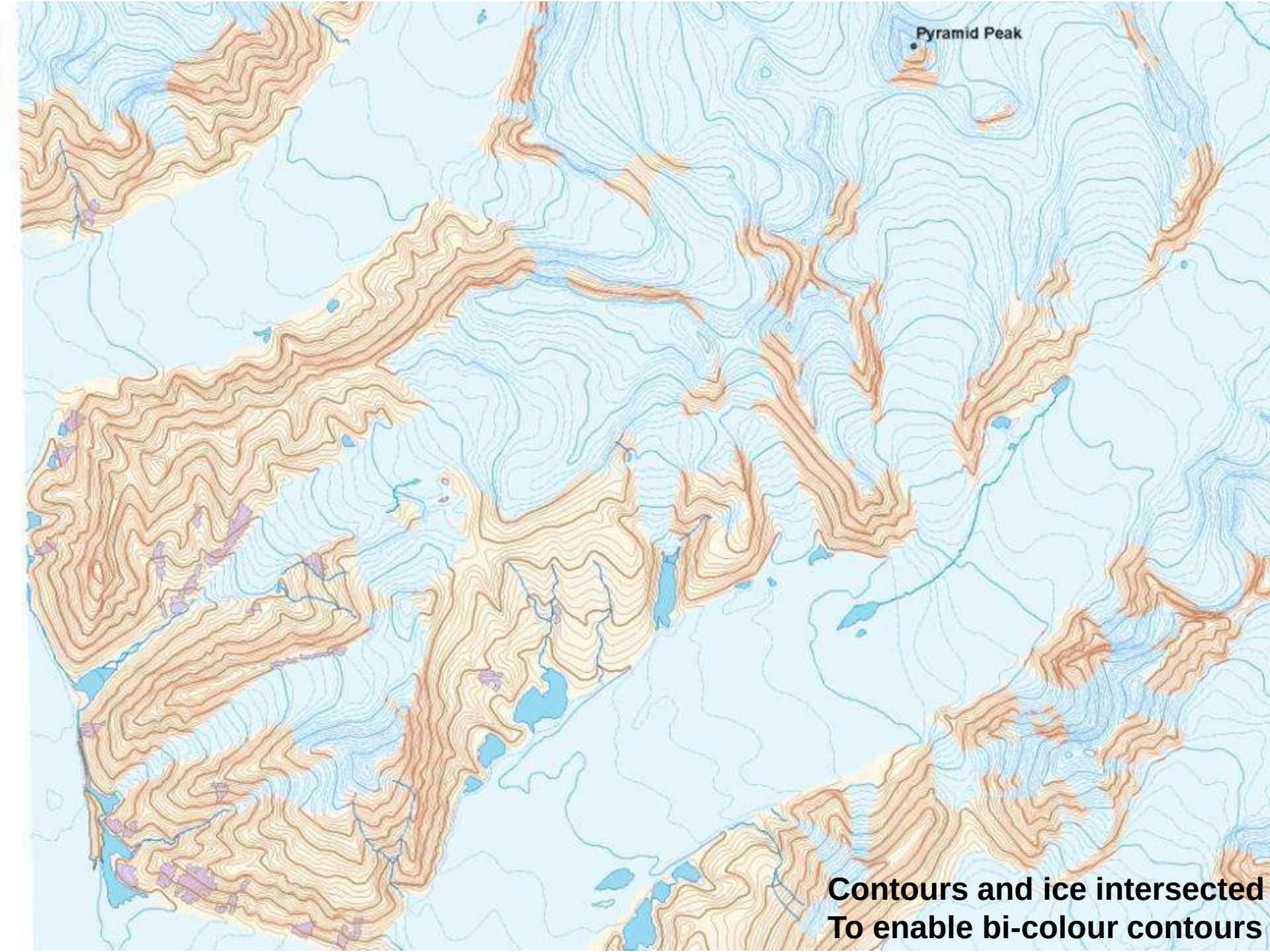
NTS map 059H12

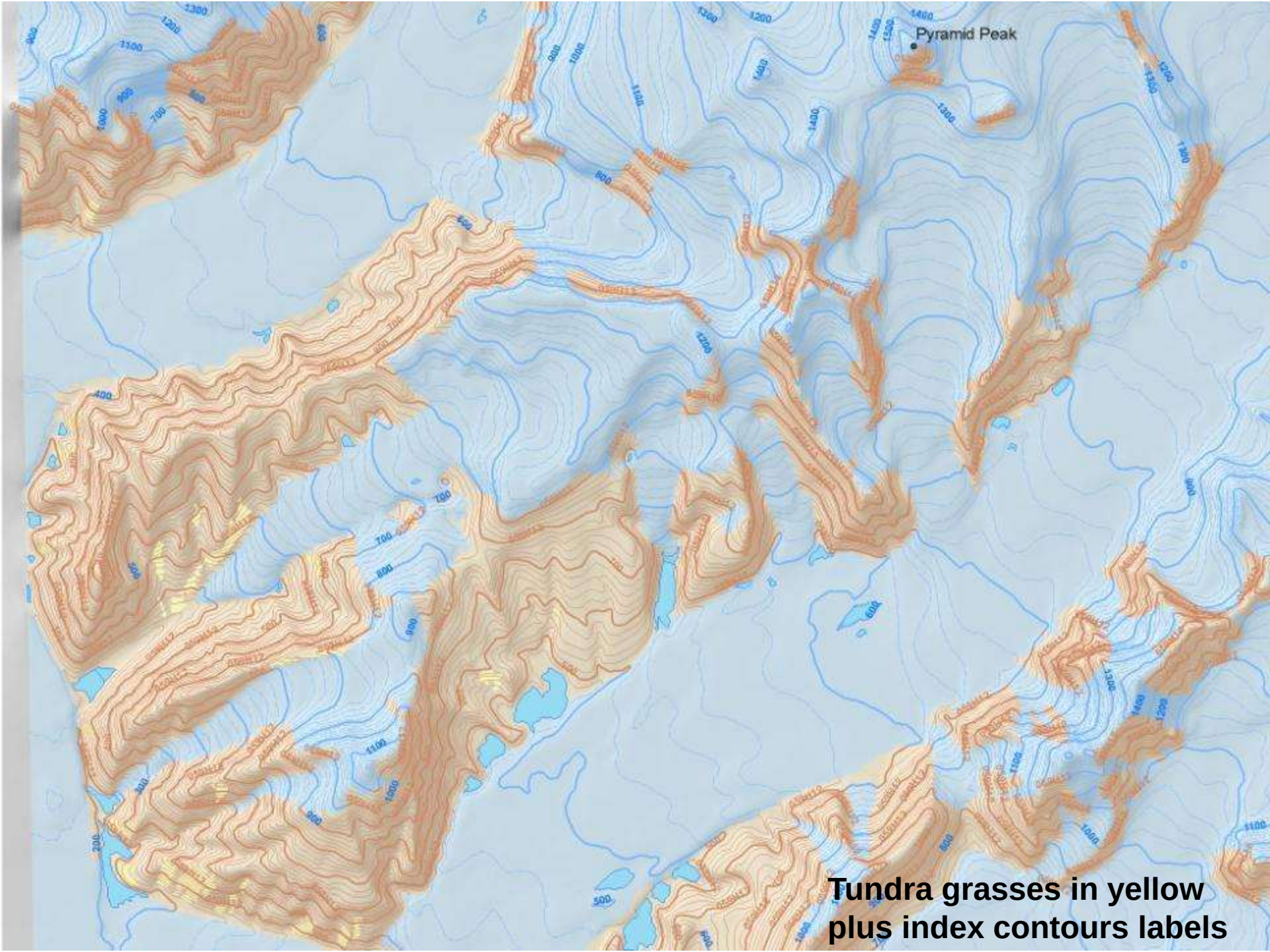
Pyramid Peak (2012)



NASA 2000
Landsat 7


WJ
WJ
GLACIER
PRINCESS
MARGARET
RANGE
Map subset area


Pyramid Peak
Contours and ice intersected
To enable bi-colour contours

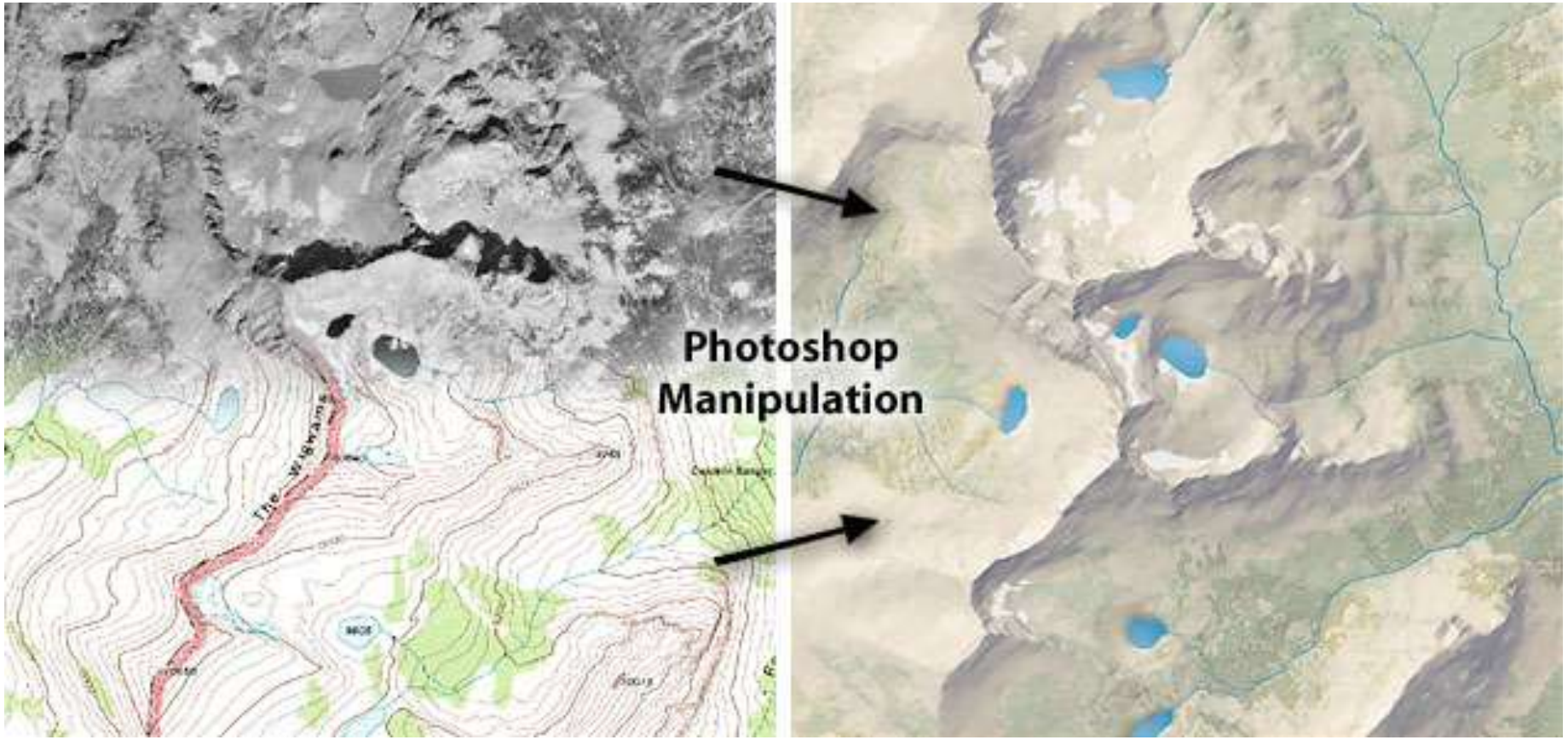


Tundra grasses in yellow plus index contours labels

Sample mountain cartography from projects 2024

International Mountain workshop commission- biennial workshop
Berchtesgaden, Austria-Germany

http://www.mountaincartography.org/activities/workshops/index.php



Realism:
http://www.shadedrelief.com/realism

New Zealand: Geographx, Roger Smith ‘Mapsmith’ – NZ track maps

https://geographx.co.nz/services-products/printed-maps/milford-track-2/

Tom Patterson http://shadedrelief.com/maps-and-data.html

Bernhard Jenny: http://www.reliefshading.com/


OSTTIROL-ÖSTERREICH
HOHE TAUERN
VENEDIGER GRUPPE
GLOCKNER GRUPPE
VIRGENTAL
NATIONALPARK
DEFEREGGENTAL
KALSERTAL
SCHOBERGRUPPE
ISELTAL
VILLGRATER BERGE
HOCHPUSTERTAL
OBERES DRAUTAL
LIENZER DOLOMITEN
LESACHTAL
KARNISCHE ALPEN
Matrei
Huben
Ainet
Lienz
Sillian
ÖSTERREICH
Osttirol
Eric Knight maps

Summary of Mountain cartography methods:

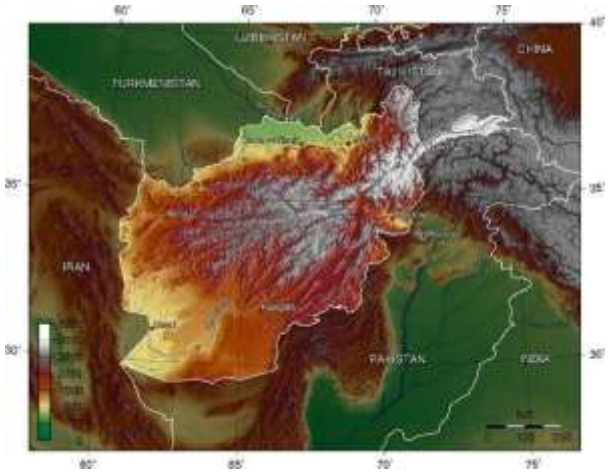
All relief methods used, especially shaded relief, contours, panoramas

Online topographic map viewers / mountain countries

Switzerland: http://map.geodataviewer.admin.ch/geodatenviewer.php

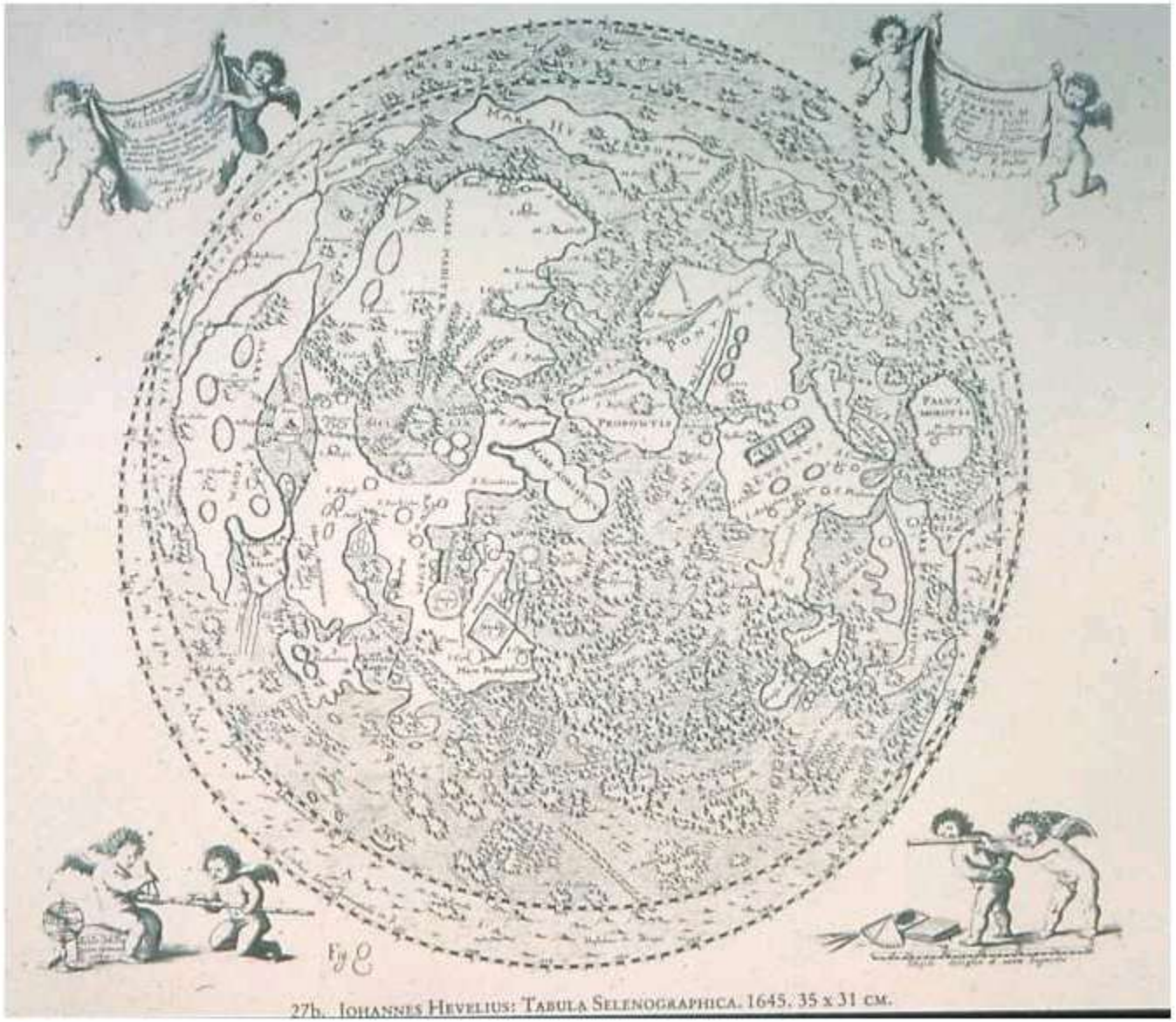
New Zealand: https://www.topomap.co.nz/

Norway statkart: http://www.norgeskart.no



Afghanistan, DEM

5. Mapping the Planets: The Moon, 1645

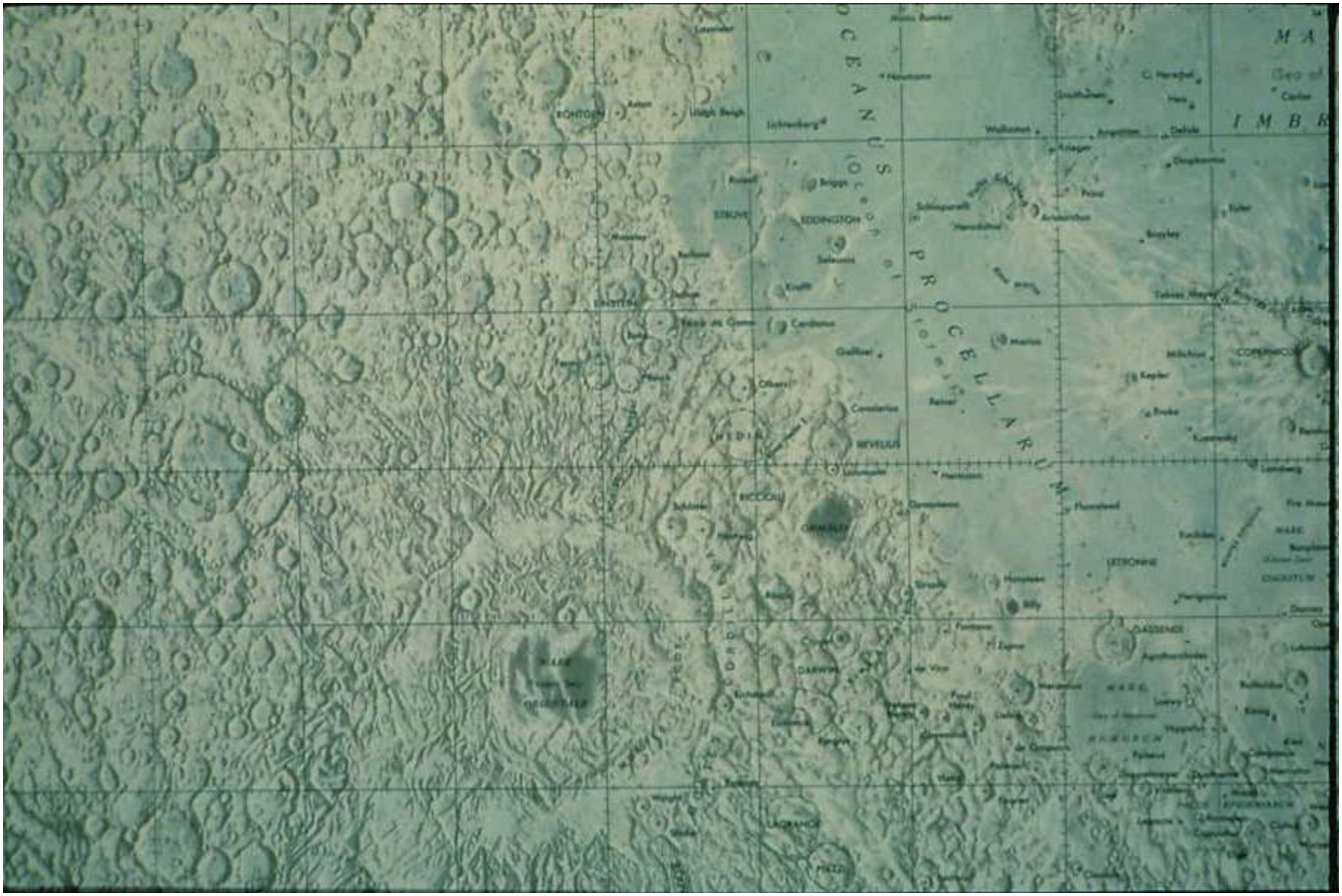


27b. Iohannes Hevelius: Tabula Selenographica. 1645. 35 x 31 cm.

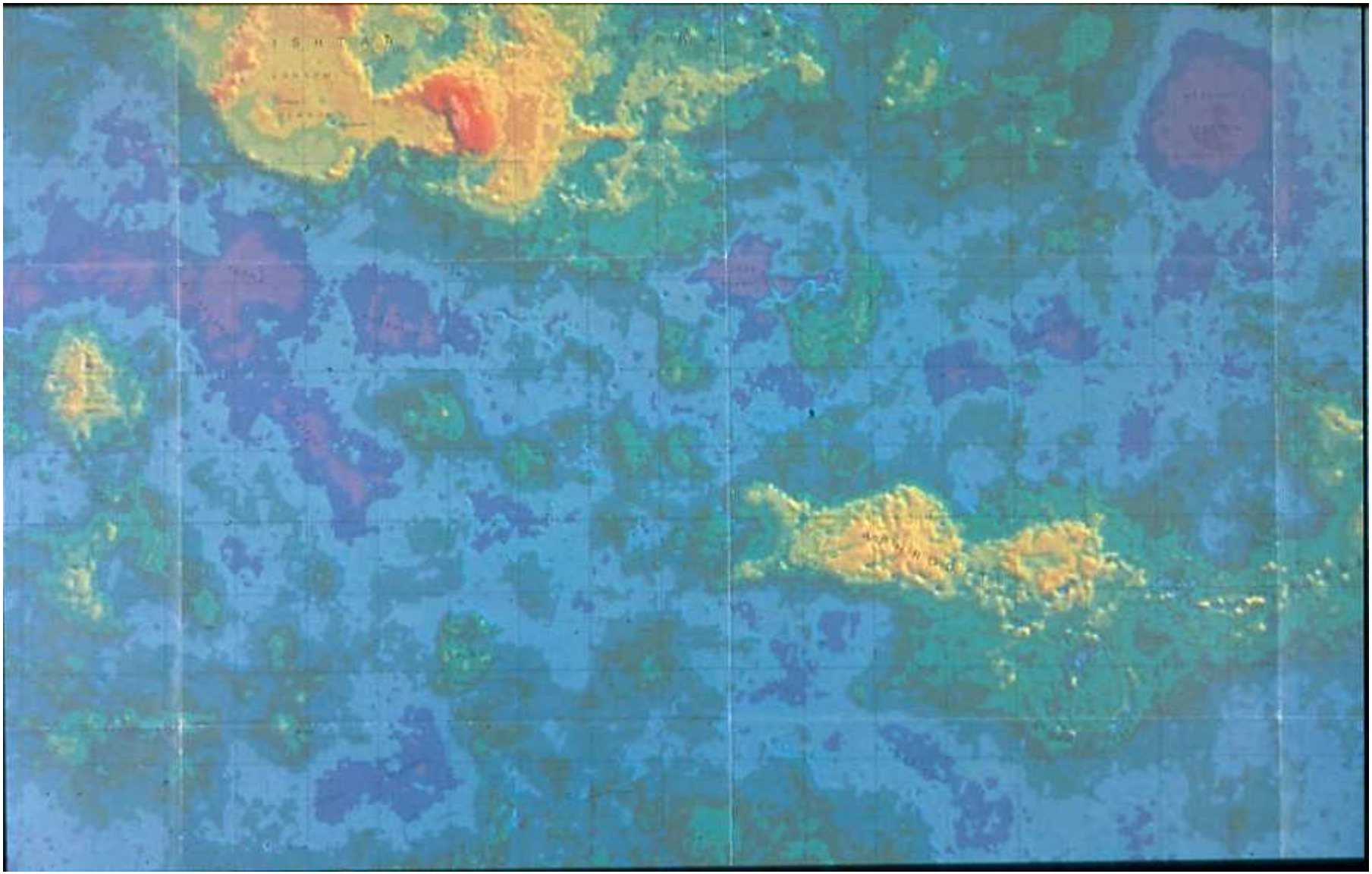
From telescopes, with hills, ‘rivers’ and ‘libration’ zones

1968 Soviet example, 1:1,000,000 shaded relief

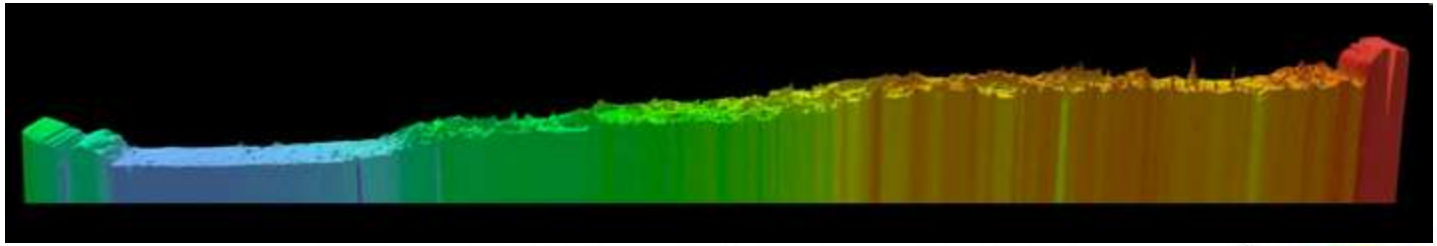
1970: US – used to plan future moon landings, 1:10,000,000

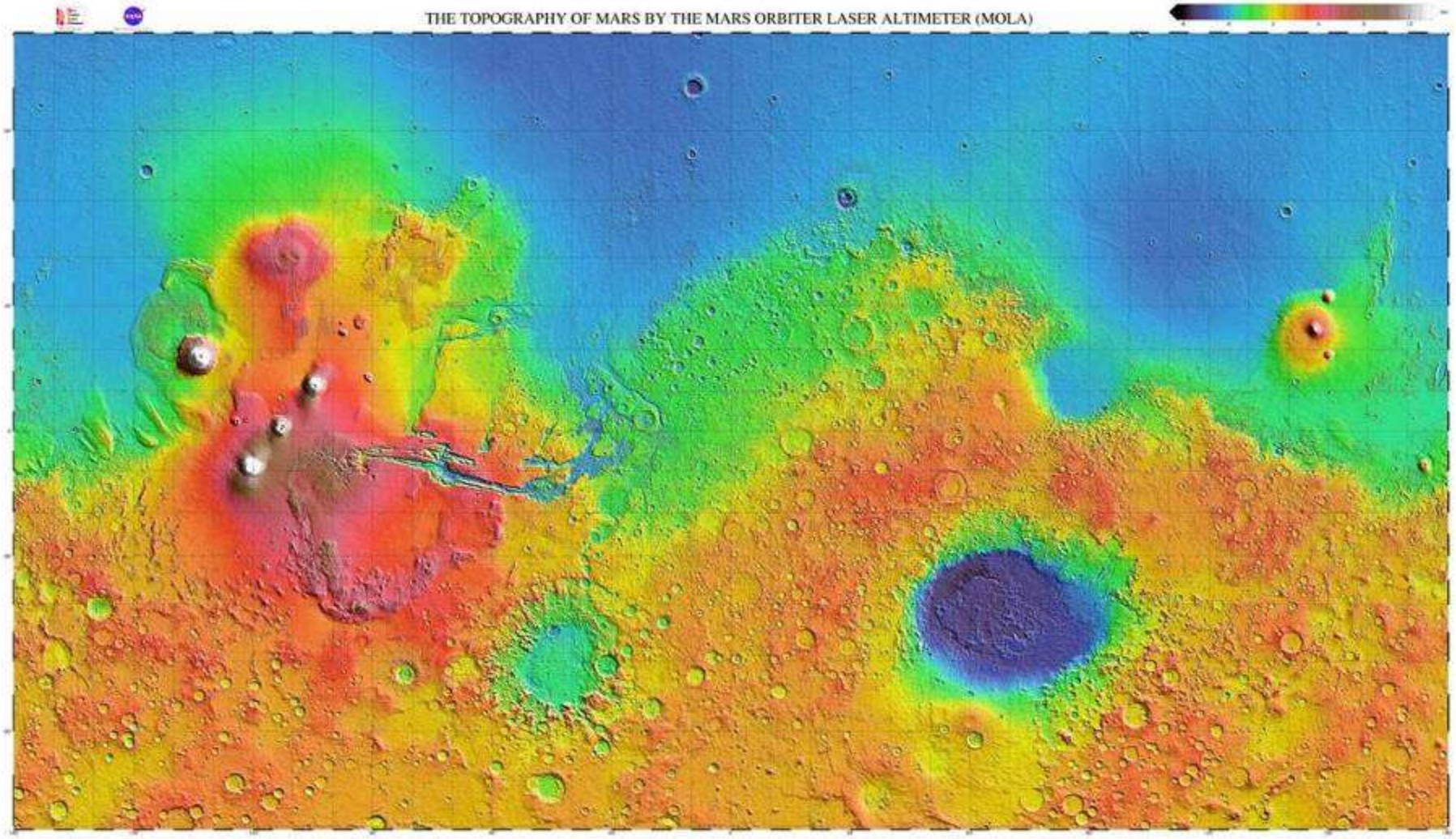


Venus 1978 from radar altimetry (through haze/clouds)



MARS: DEM resolution in z = 30cm! (N. Pole to S. Pole transect)





https://www.google.ca/mars

Elevation, Panchromatic, Thermal