Poznań
16.12.2022 r.

Spitsbergen – kraina lodu i niedźwiedzi

prof. dr hab. **Grzegorz Rachlewicz**

Pracownia Badań Kriosfery

ROŻNE OBLICZA GEOGRAFII

Ministerstwo Edukacji i Nauki

Uniwersytet im. Adama Mickiewicza w Poznaniu

Wydział Nauk Geograficznych i Geologicznych

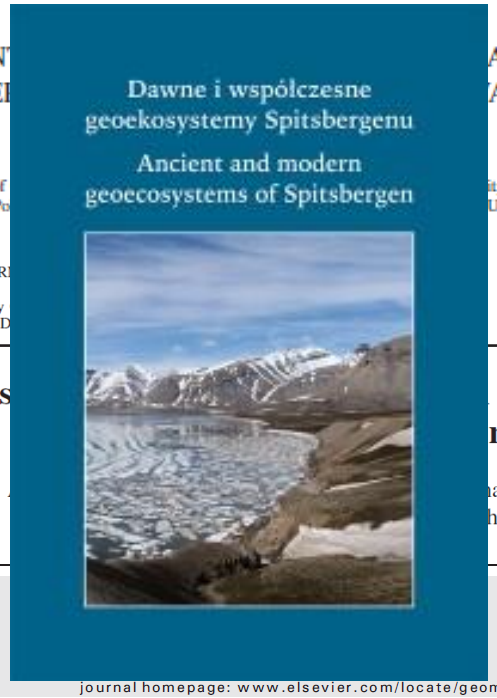
UNIWERSYTET IM. ADAMA MICKIEWICZA W POZNANIU
Wydział Nauk Geograficznych i Geologicznych
Instytut Geoekologii i Geoinformacji
Zakład Badań Kriosfery

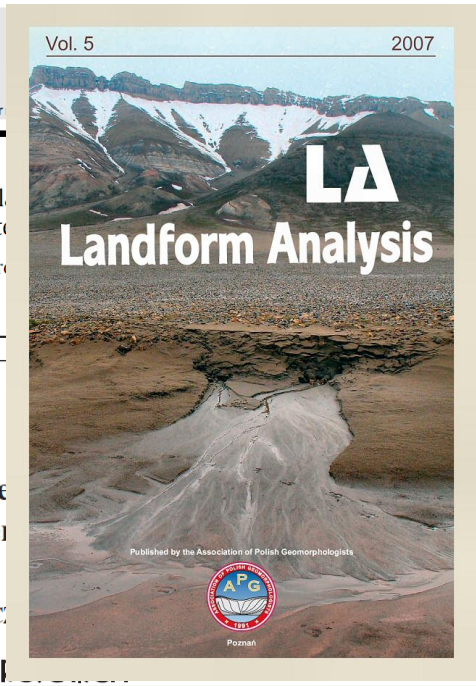
Wyprawy Wydziału Nauk Geograficznych i Geologicznych UAM do Zatoki Petunia na Spitsbergenie

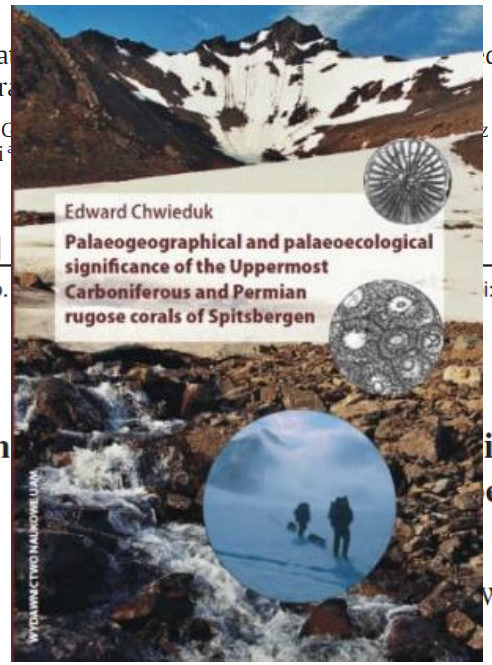
1984, 1985, 1986, 1987, 1989,
2000, 2001, 2002, 2003,
2005, 2006, 2007, 2008, 2009, 2010,
2011, 2012, 2013, 2014, 2015, 2016,
2017, 2018, 2019, 2020, 2021, 2022...

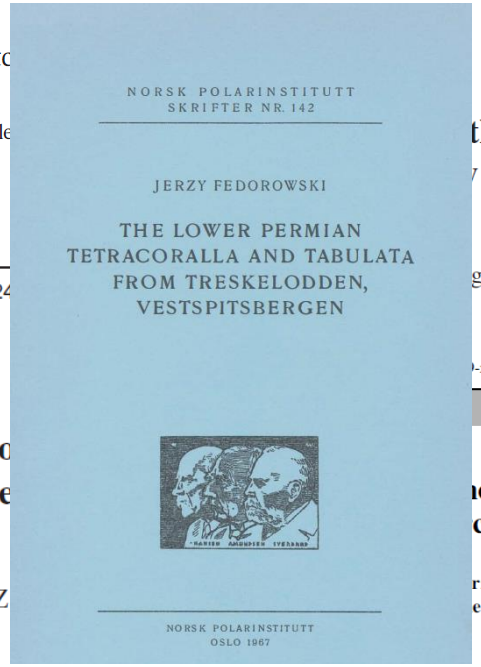
STACJA POLARNA
UNIWERSYTETU im. ADAMA MICKIEWICZA w POZNANIU
„PETUNIABUKTA", SPITSBERGEN

Grzegorz Rachlewicz – grzera@amu.edu.pl









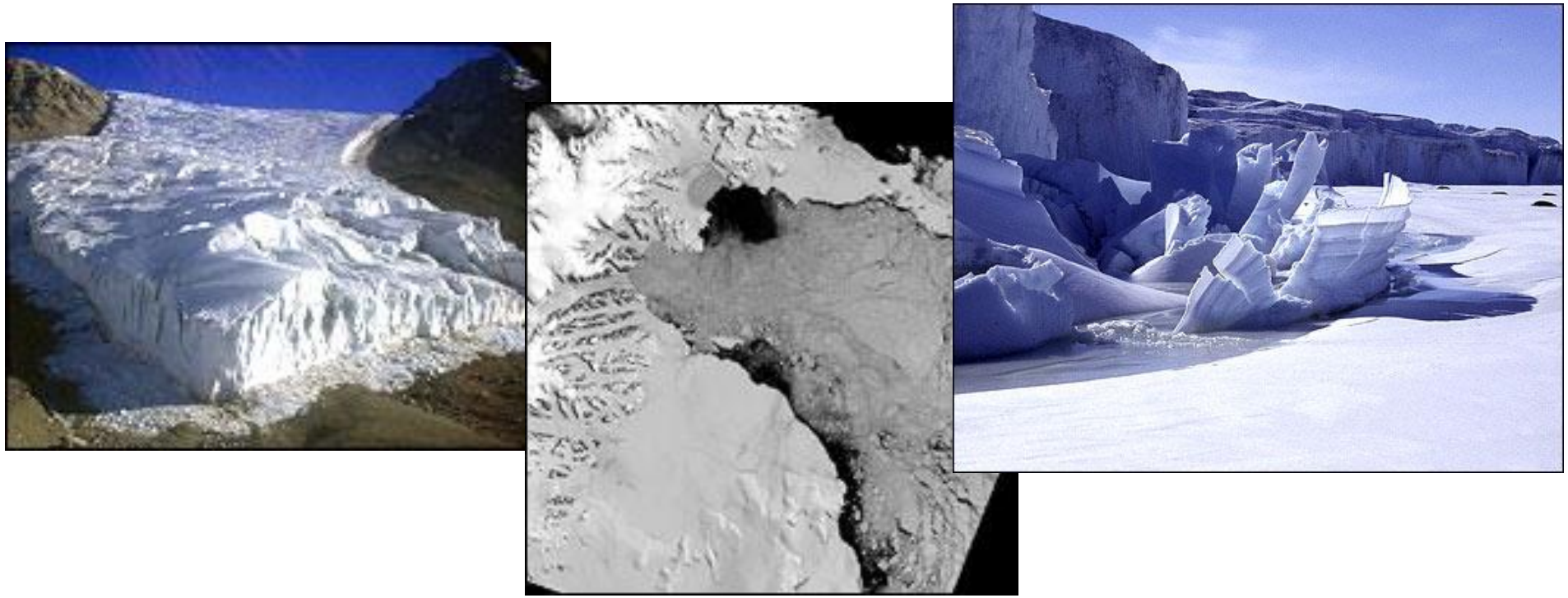
Quaternary paleogeography and present-day processes in an area between Billefjorden and Austfjorden, central Spitsbergen

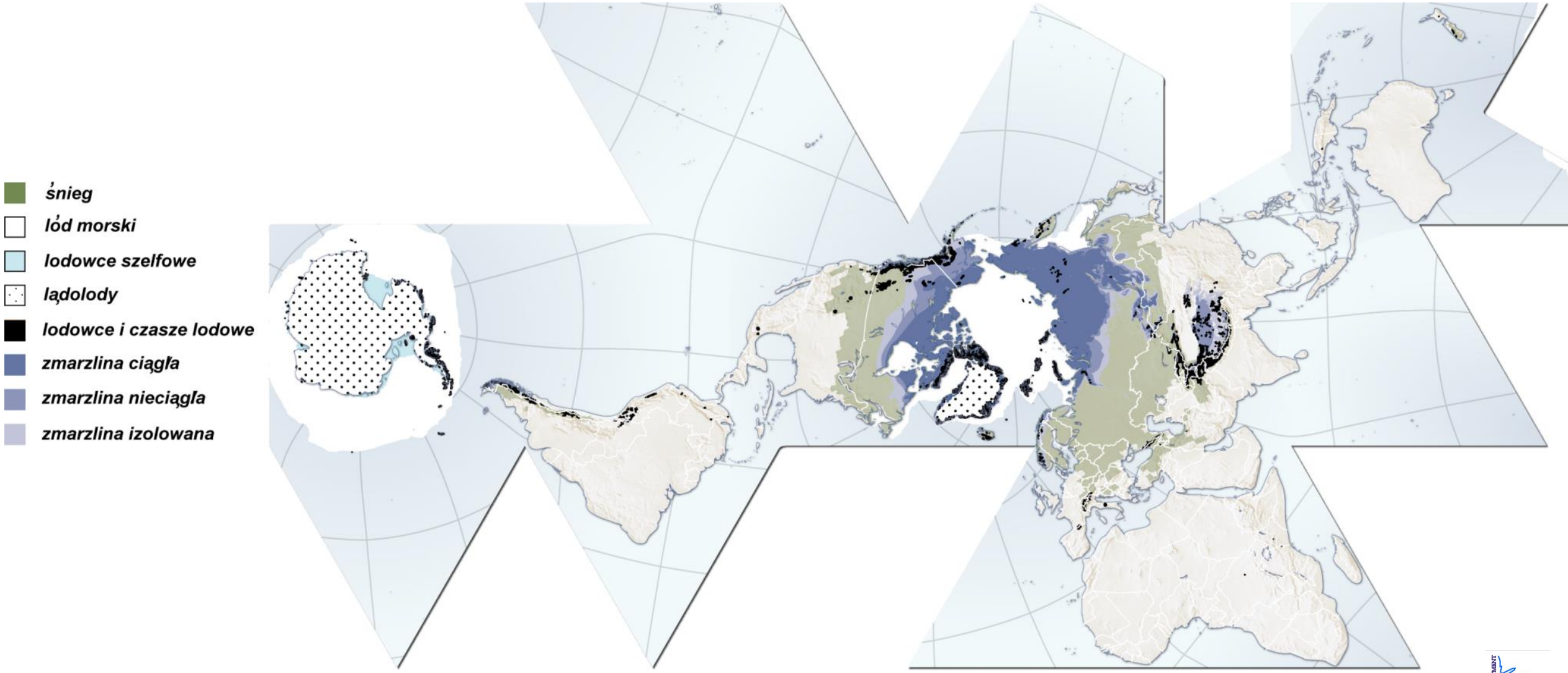
Edited by Wojciech STANKOWSKI

KRIOSFERA – KRIOLOGIA

CHIONOSFERA – CHIONOLOGIA

GLACISFERA – GLACJOLOGIA

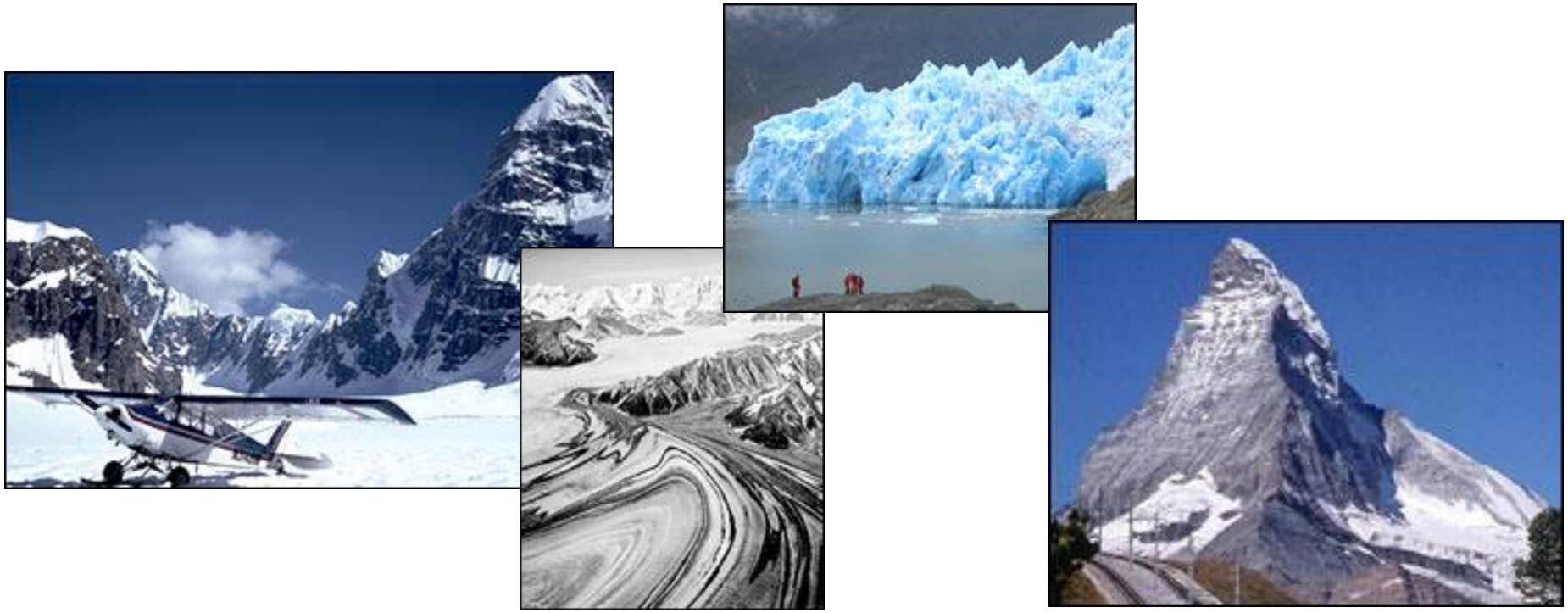


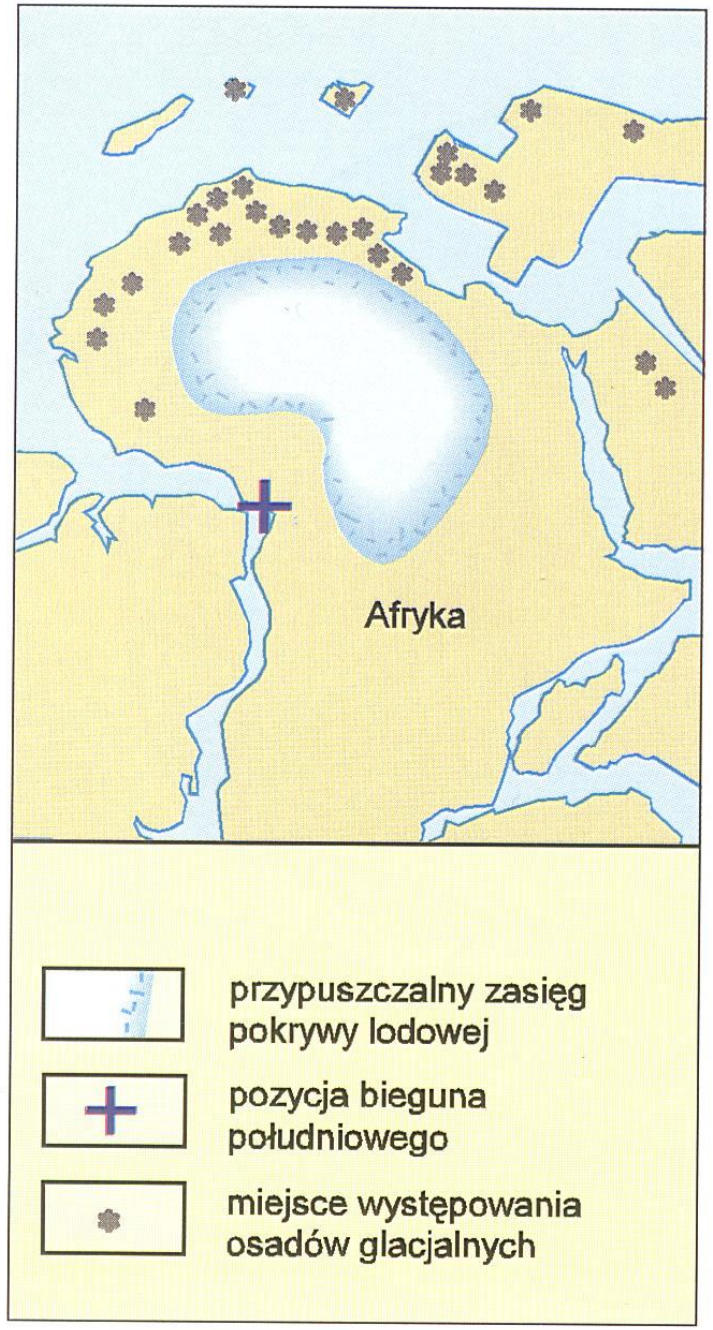


Kriosfera w odwzorowaniu Fullera (NSIDC/WDCG)

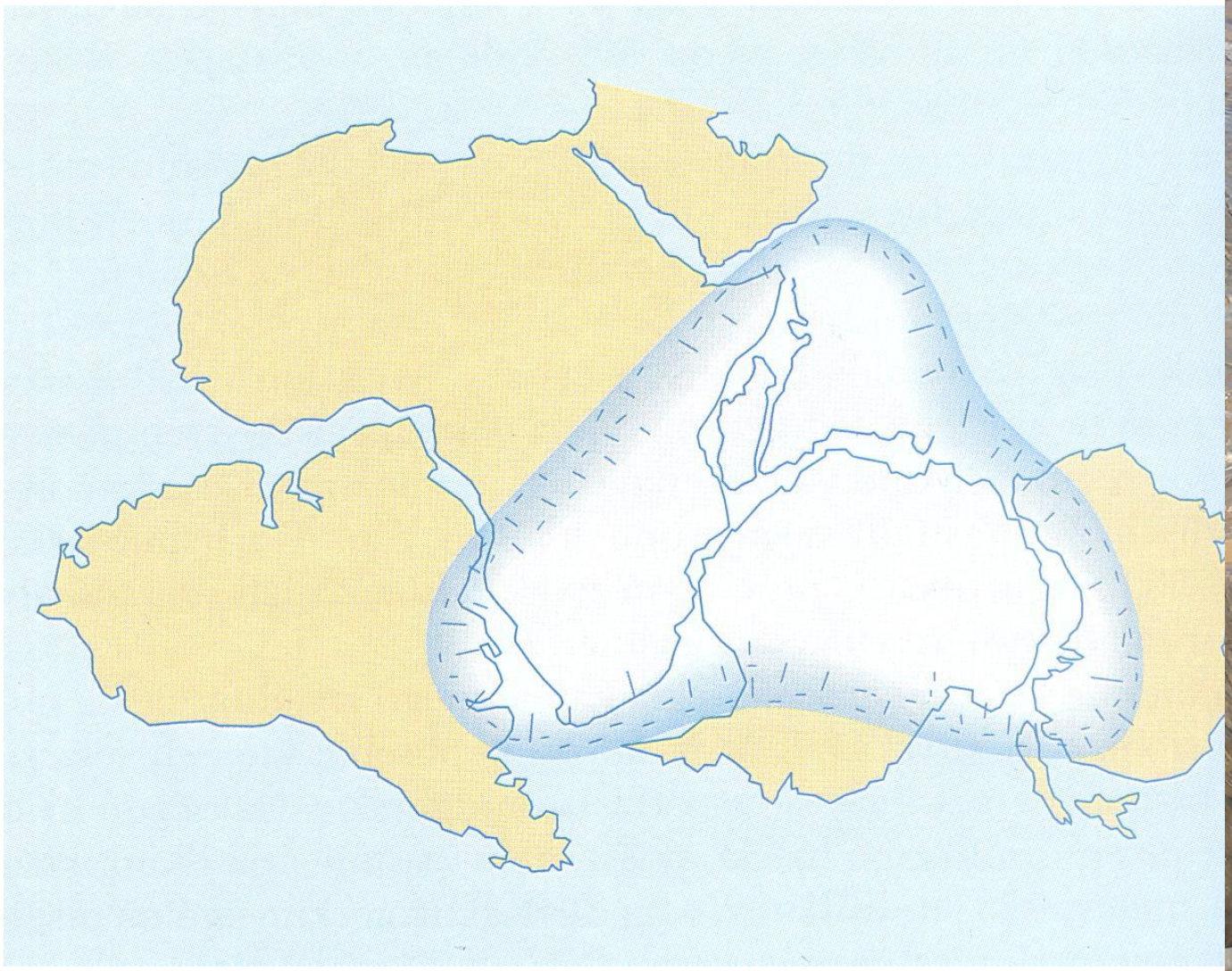
Glacjologia to nauka o lodzie we wszystkich jego postaciach i badanie zjawisk naturalnych w których mamy do czynienia z lodem na Ziemi i innych planetach (kriologia).

Glaciologia jest nauką o lodowcach. Jest interdyscyplinarną dziedziną nauk o środowisku integrującą geofizykę, geologię, klimatologię, meteorologię, hydrologię, biologię i ekologię. Jest też częścią geografii fizycznej.





Zlodowacenie ordowickie
(460-440 mln lat)
(Roberdat, Dore 1988)



Zlodowacenie Gondwany karbon/perm (300-280 mln lat)

(za Borówką 1998)

LĄDOLODY W EUROPIE W CZASIE NAJWIĘKSZEGO NASUNIĘCIA około 20 tys. lat temu

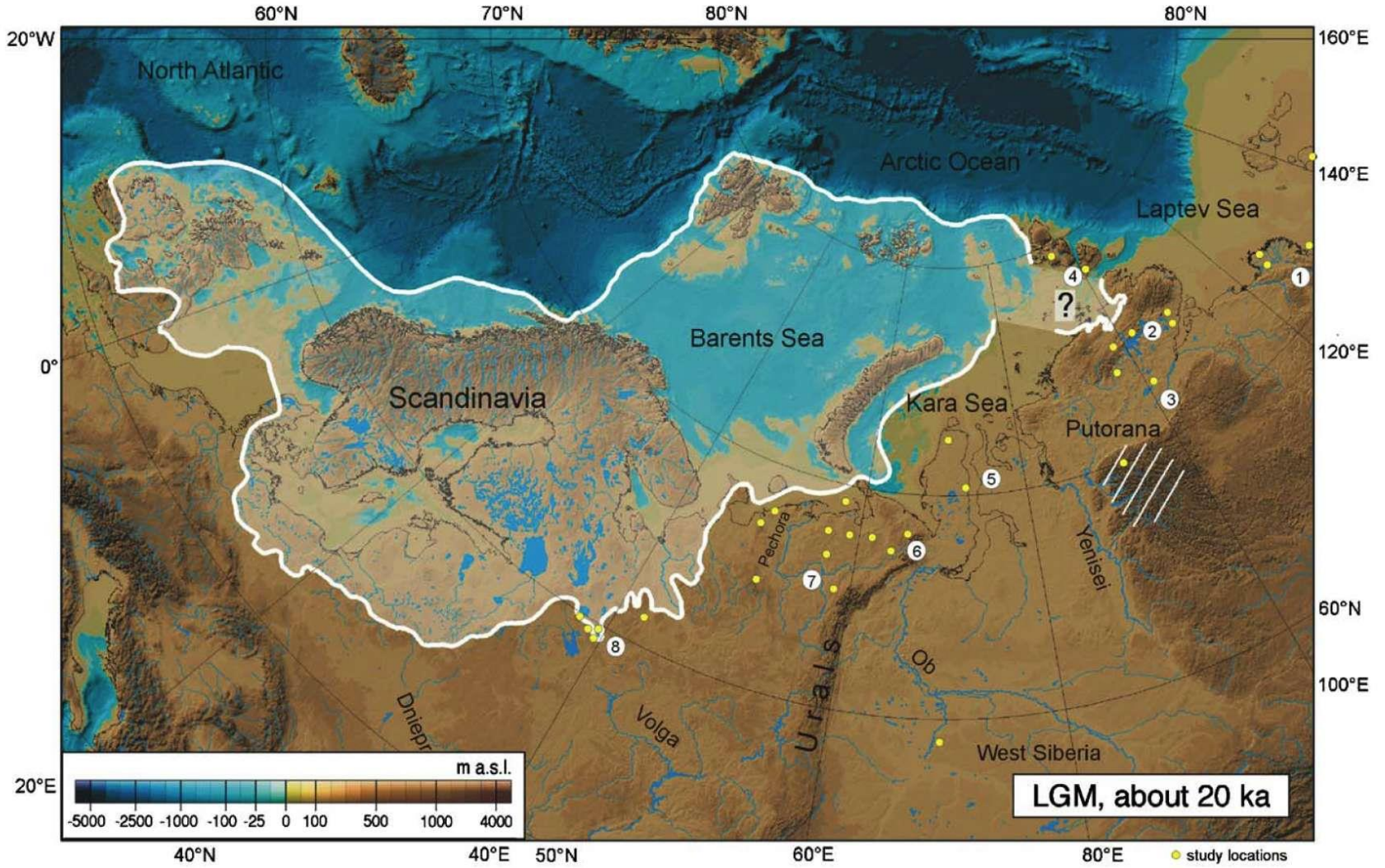


Fig. 1. Map showing the LGM Eurasian Ice Sheet according to Svendsen et al. (2004b), with the numbered working areas described in the text. (1) Laptev Sea Coast and Bykovsky Peninsula, (2) Central Taymyr Peninsula, (3) SE Taymyr Peninsula, Labaz Lake Region, (4) Severnaya Zemlya Archipelago, (5) West Siberia and Yamal Peninsula, (6) Ural Mountains, (7) Pechora Lowland, and (8) NW Russian Plain.

Svendsen i in. 2004

zlodowacenie najstarsze – 1200-950 tys. lat temu
zlodowacenie Sanu – 730-430 tys. lat temu
zlodowacenie Odry – 300-170 tys. lat temu
zlodowacenie Wisły – 115-11,7 tys. lat temu

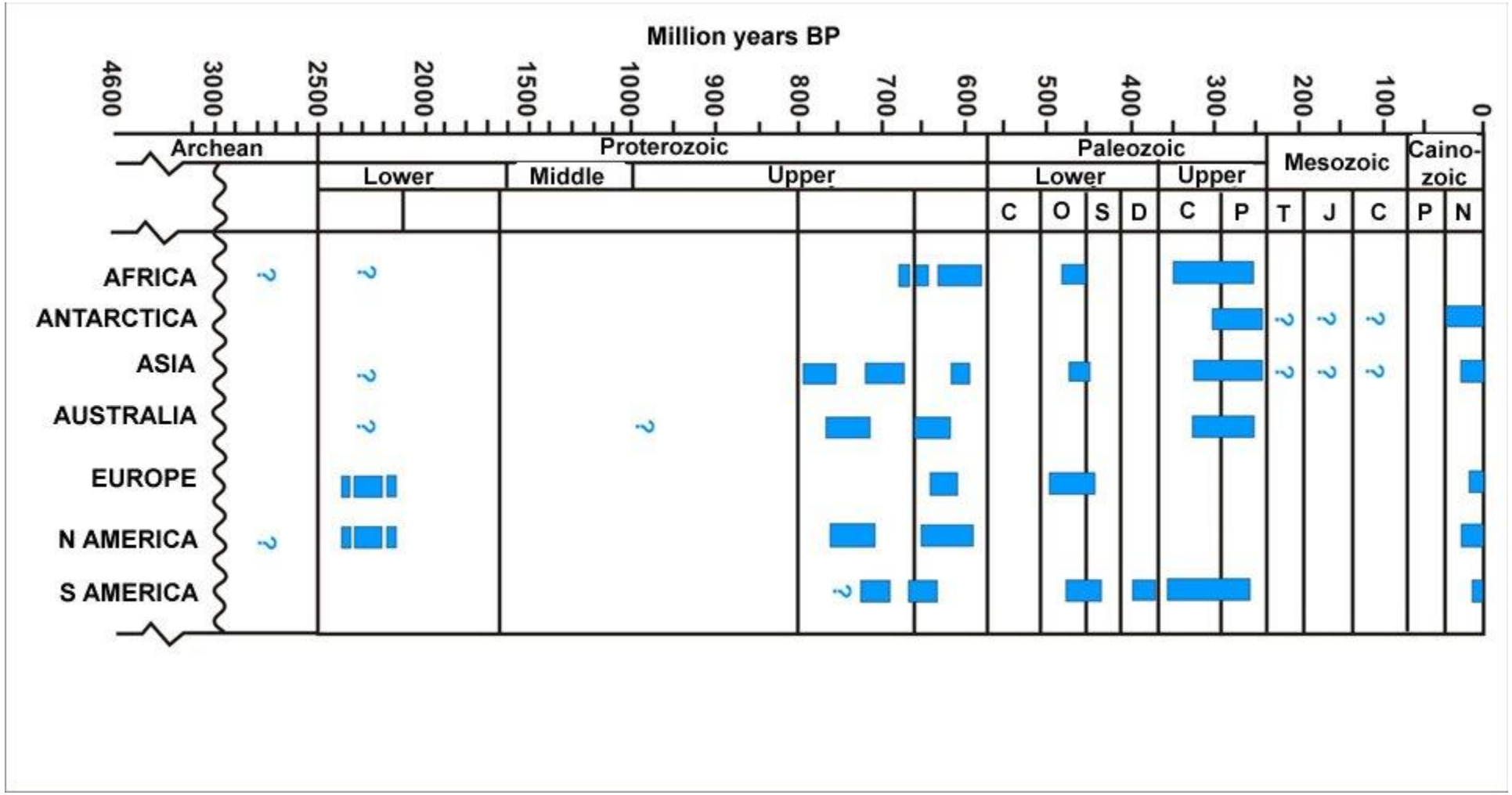

materiał morenowy: <0.002 mm - ~18 km2 (Niemcy)
głaz narzutowy

Maksimum ostatniego zlodowacenia	Mln km^3
Lądolód grenlandzki	**3,5**
Lądolód północnoamerykański	**26,3**
Lądolód skandynawski	**11,0**
Lądolód antarktyczny	**37,7**
Pozostałe lądolody i lodowce	**1,1**
RAZEM	**79,6**

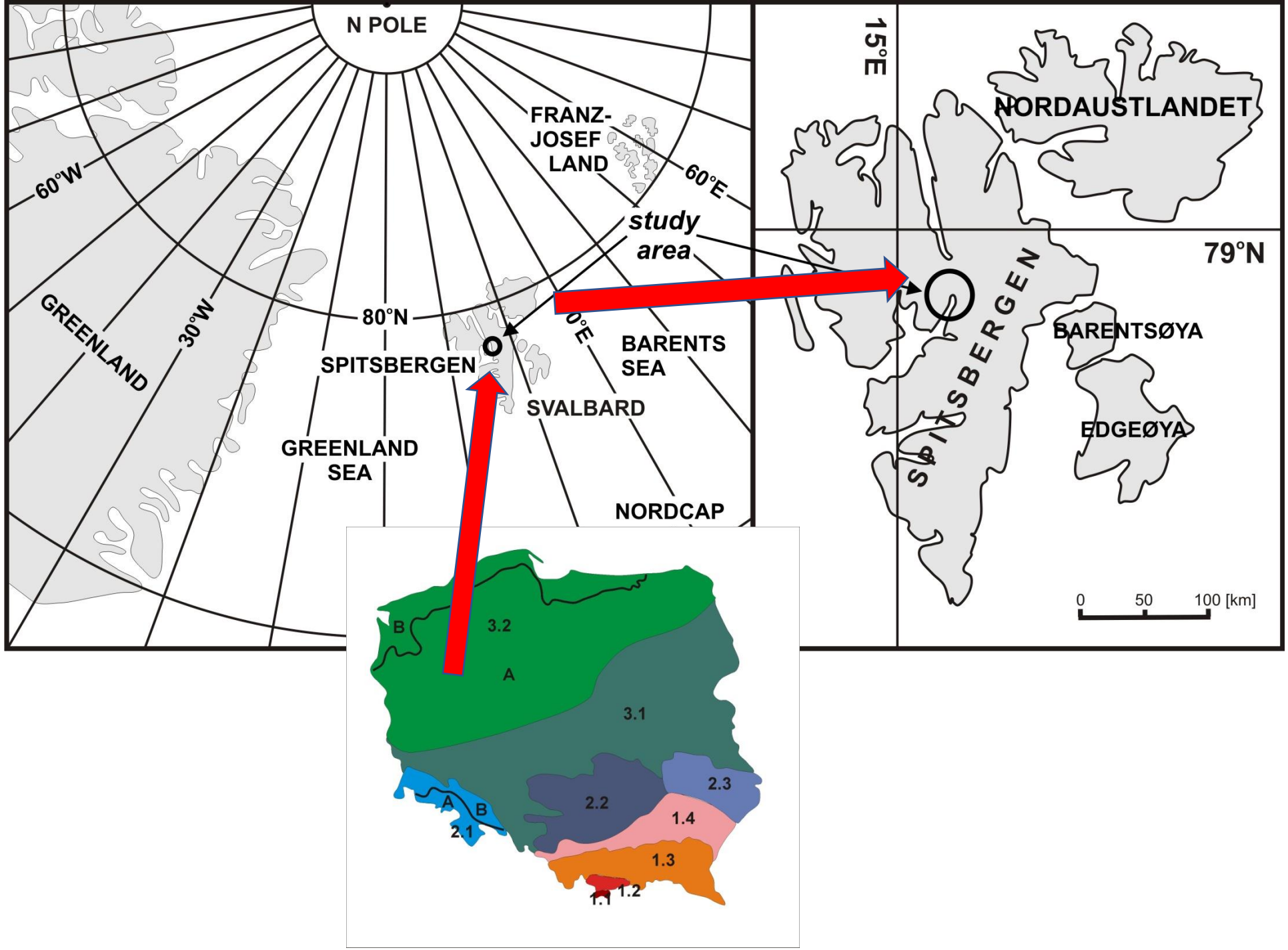
Okres współczesny	Mln km^3
Lądolód grenlandzki	**2,5**
Lądolód antarktyczny	**27,9**
Pozostałe lodowce	**0,2**
RAZEM	**30,6**

wg Flint 1971, Berger et al. 1990

ZLODOWACENIA W HISTORII GEOLOGICZNEJ ZIEMI



Eyles (1993)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JOSEF
LAND
60°W
60°E
study
area
GREENLAND
30°W
80°N
0°E
SPITSBERGEN
BARENTS
SEA
SVALBARD
GREENLAND
SEA
NORDCAP
15°E
NORDAUSTLANDET
79°N
SPITSBERGEN
BARENTSØYA
EDGEØYA
0
50
100 [km]
B
3.2
A
3.1
2.3
2.2
A
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1.2
1.1

LATA: 0

0 1 [g/cm^3]

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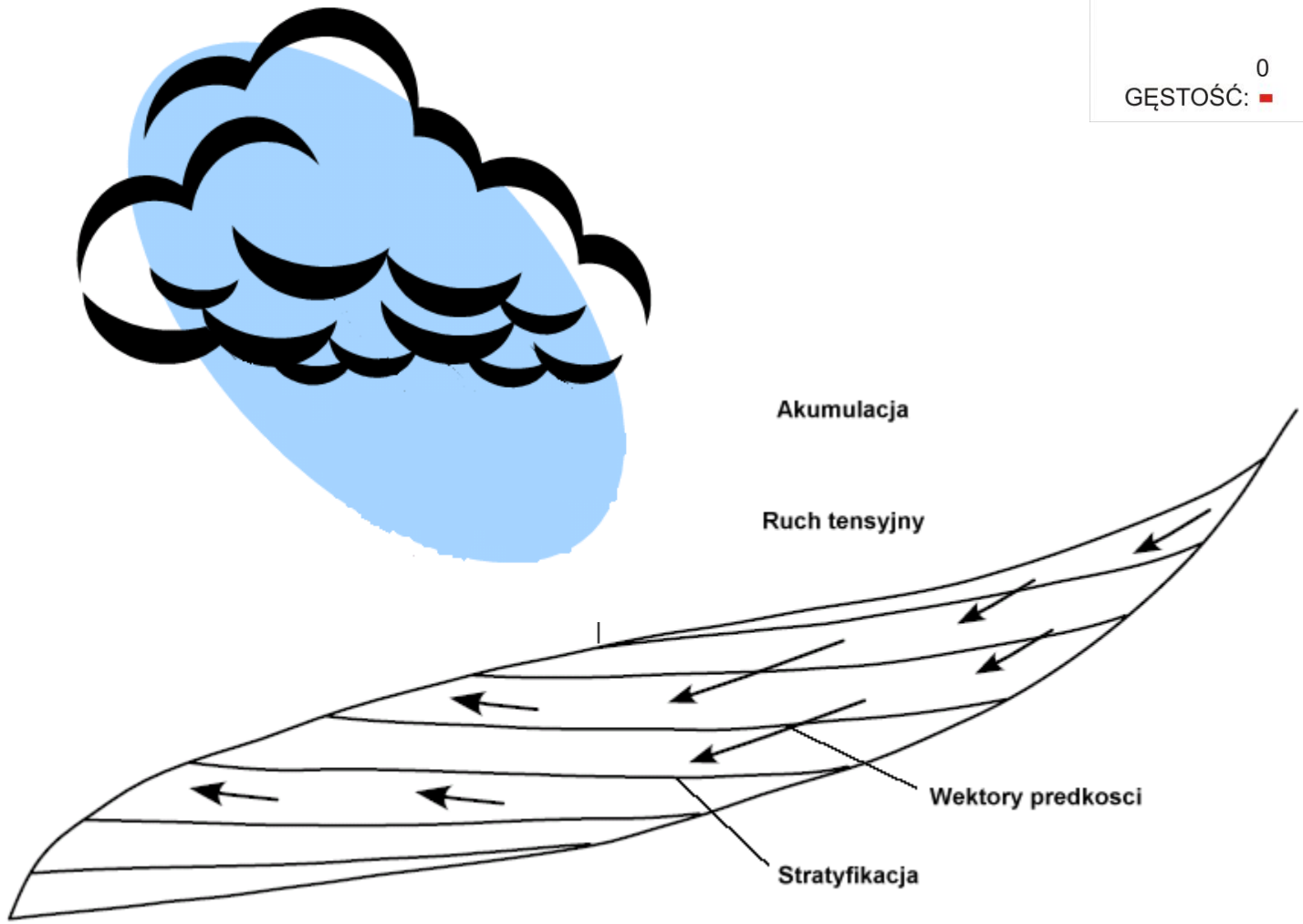

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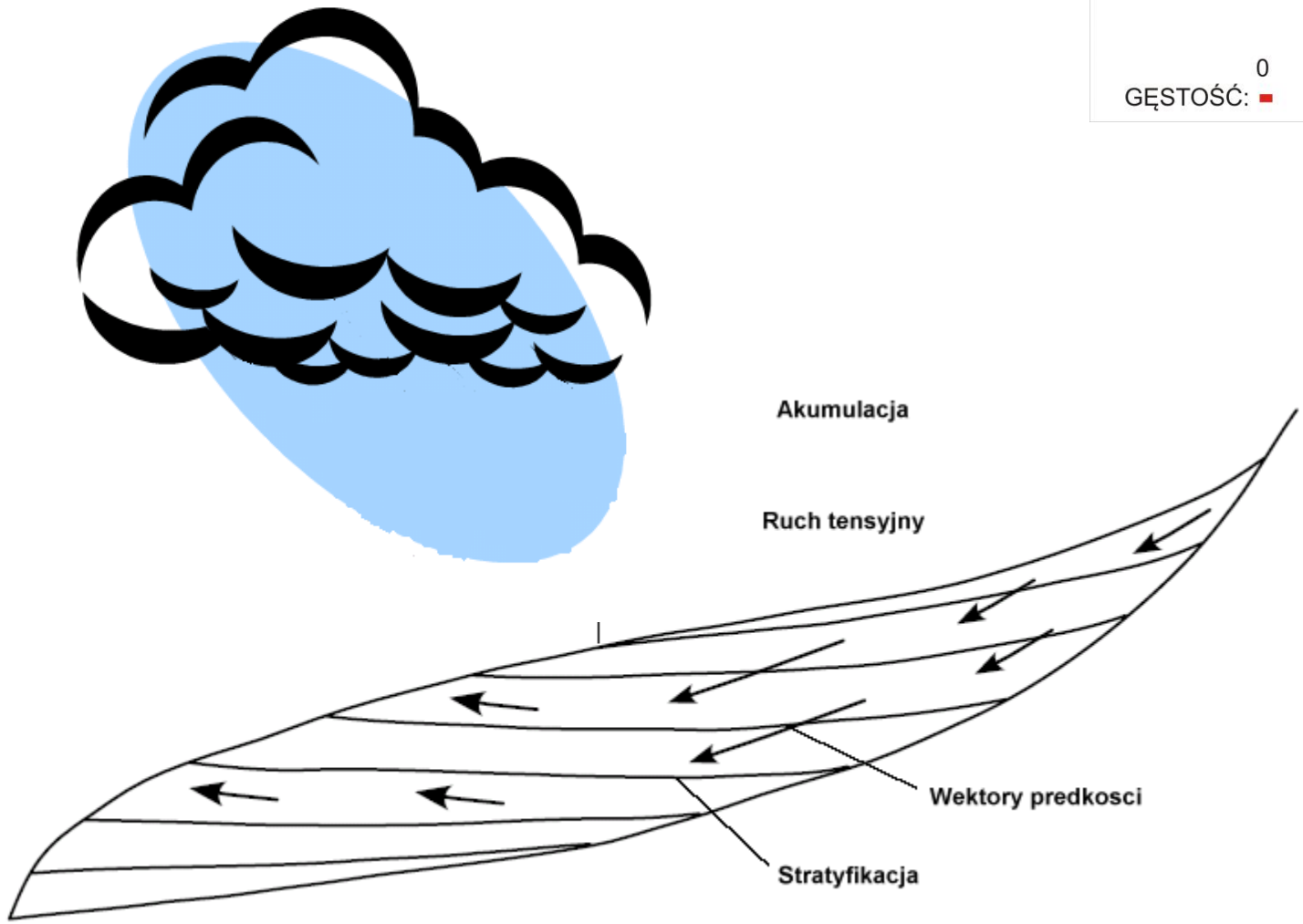

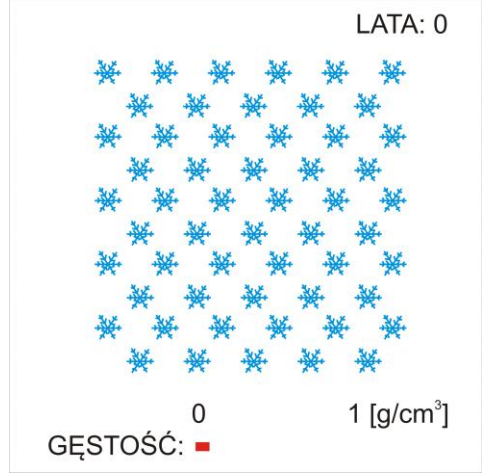
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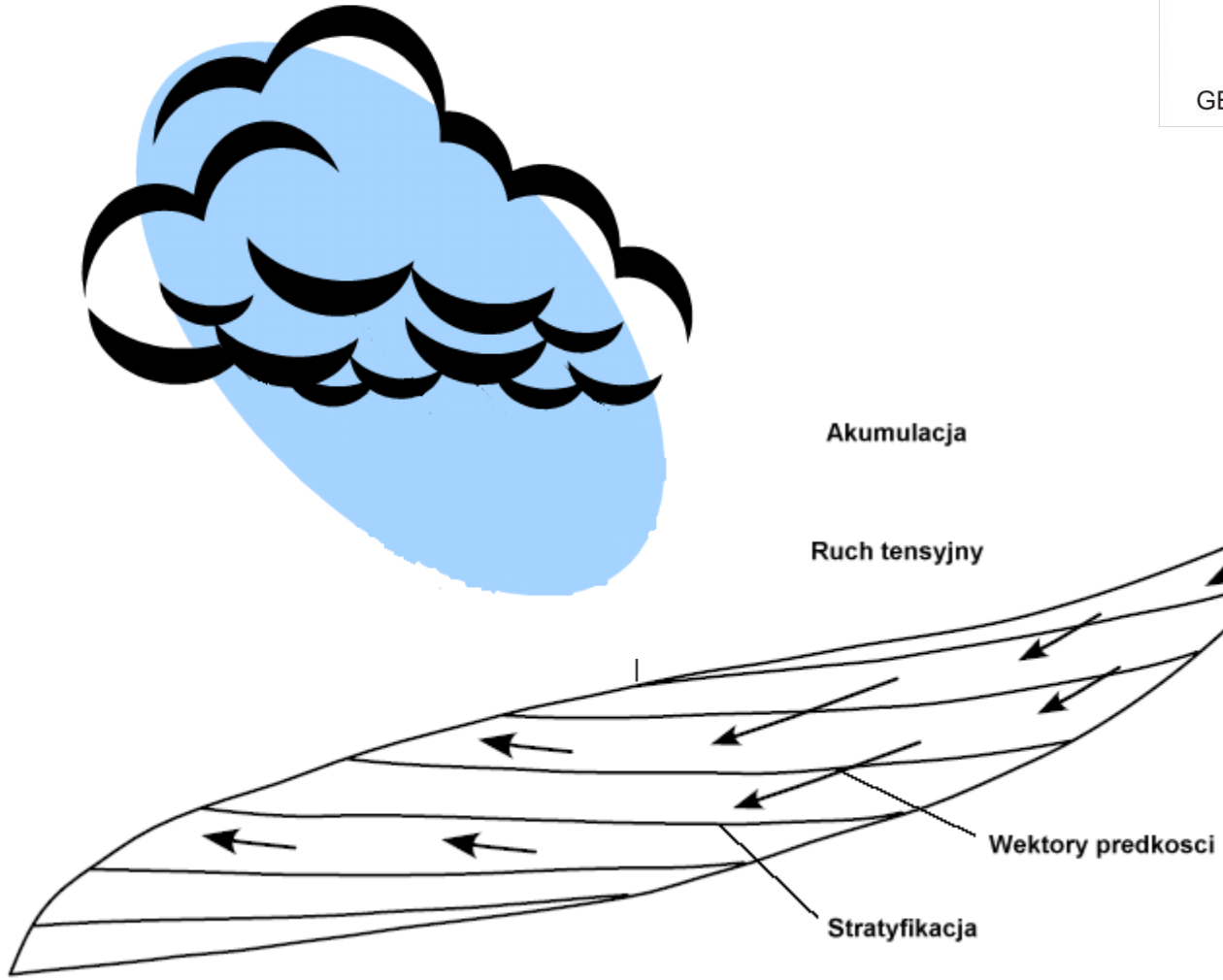
Akumulacja
Ruch tensyjny
Wektory predkosci
Stratyfikacja

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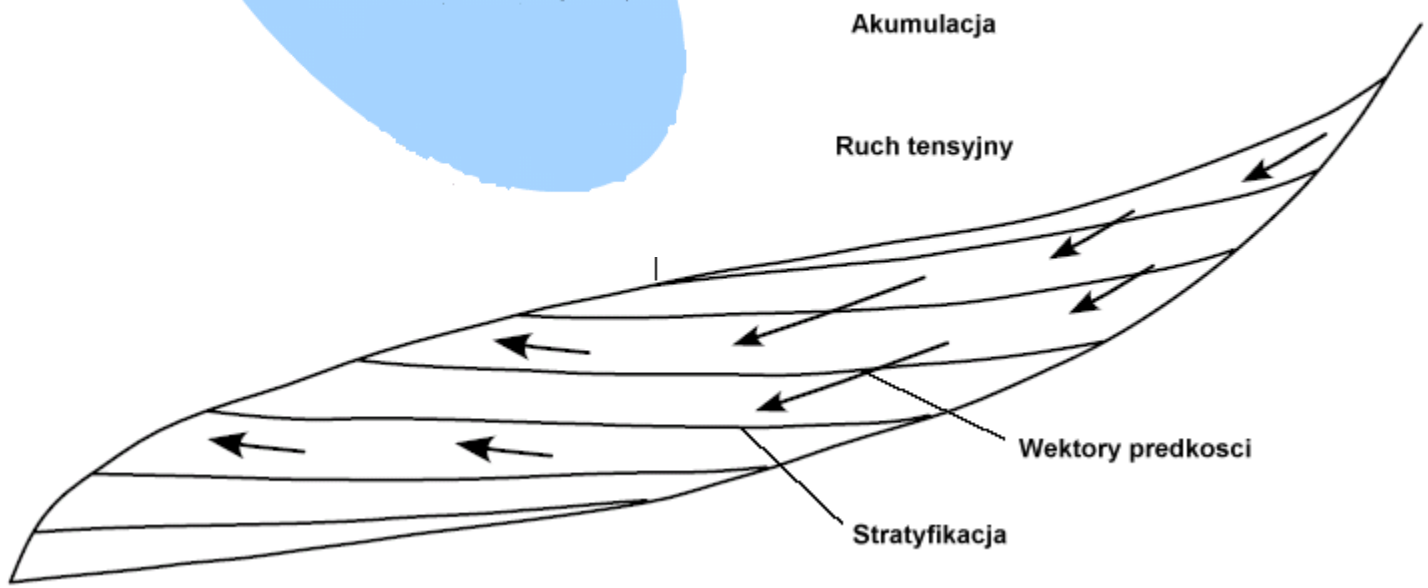

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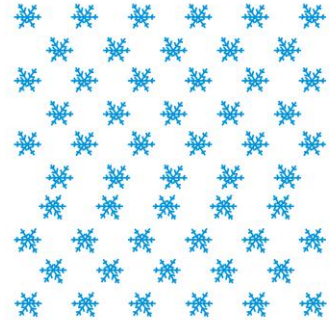

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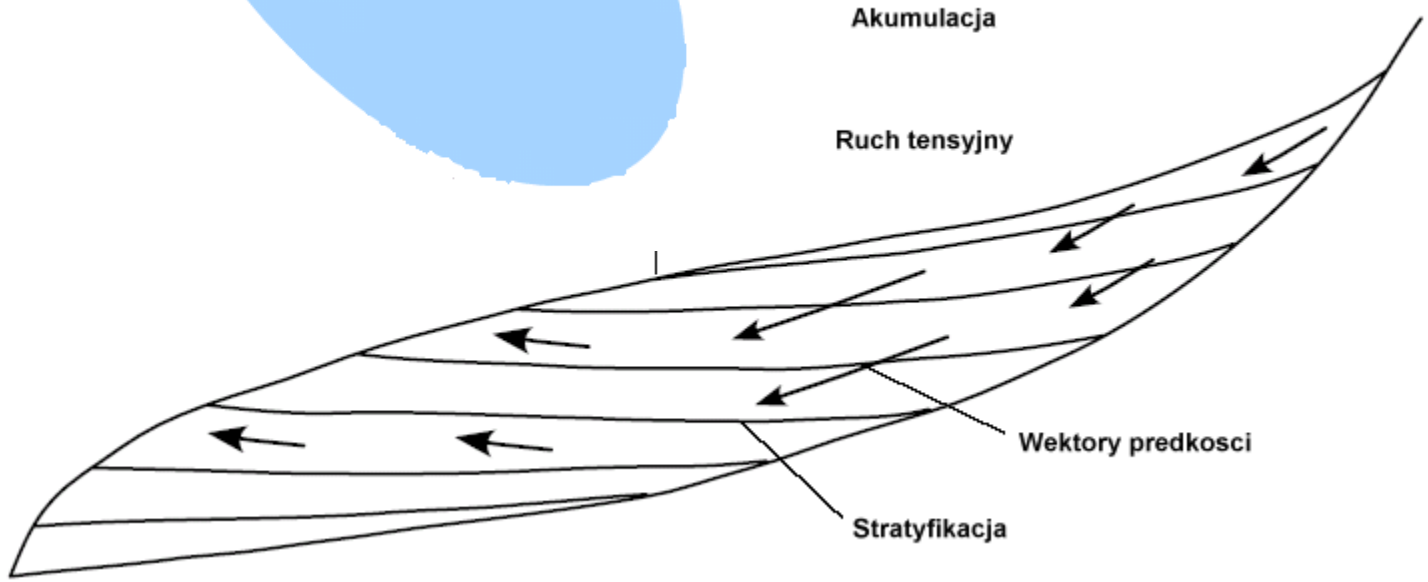

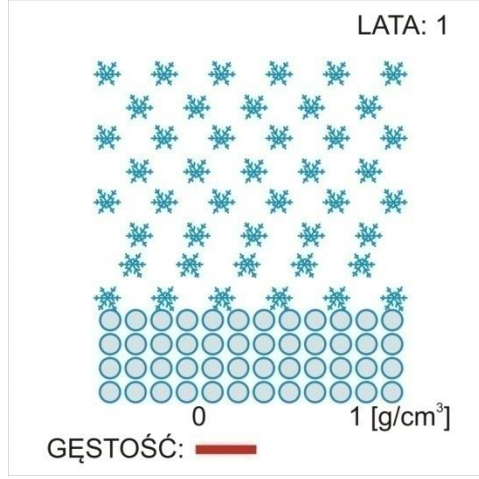
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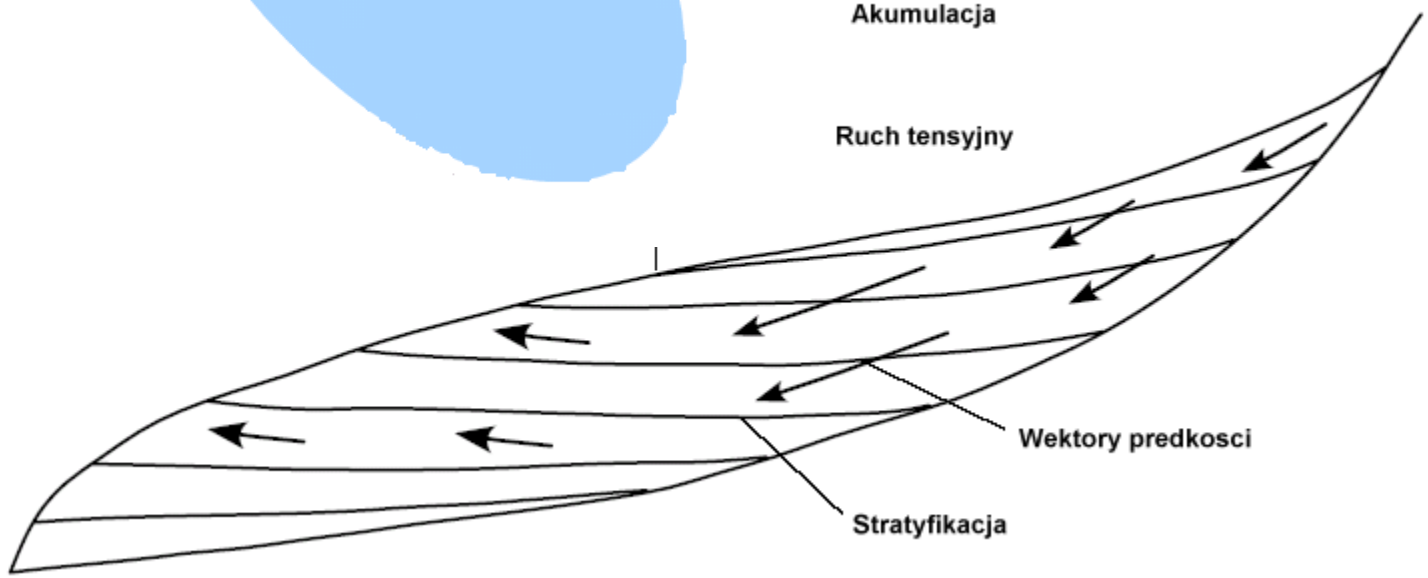
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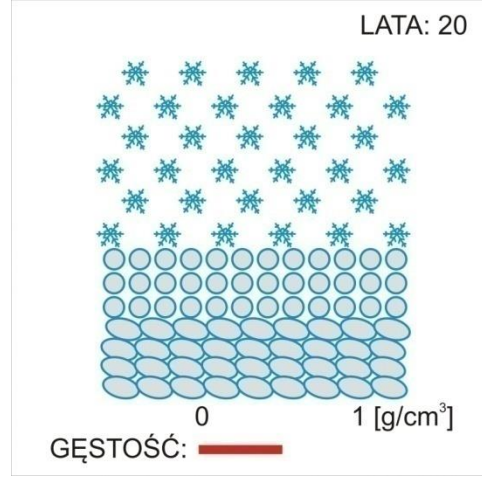
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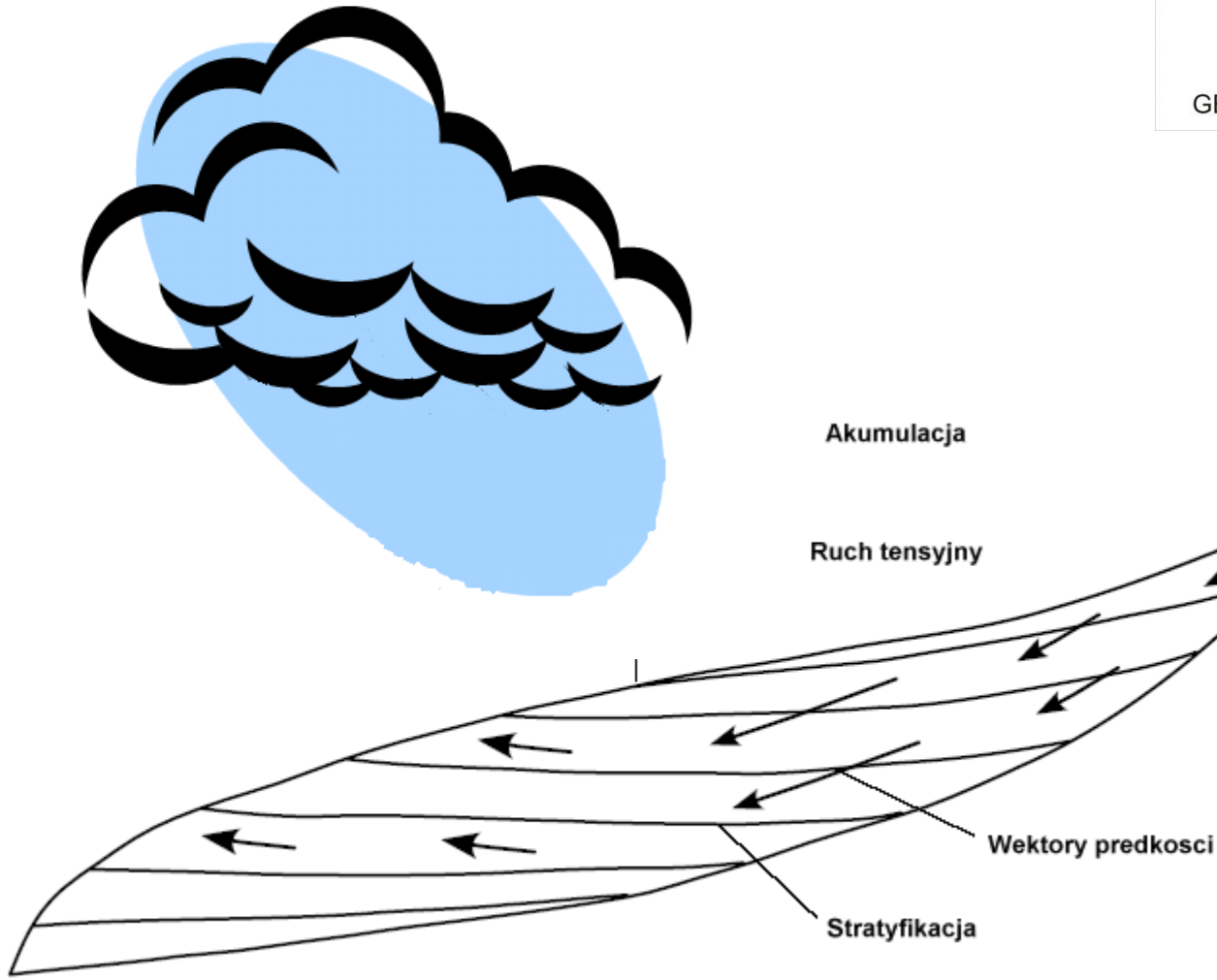
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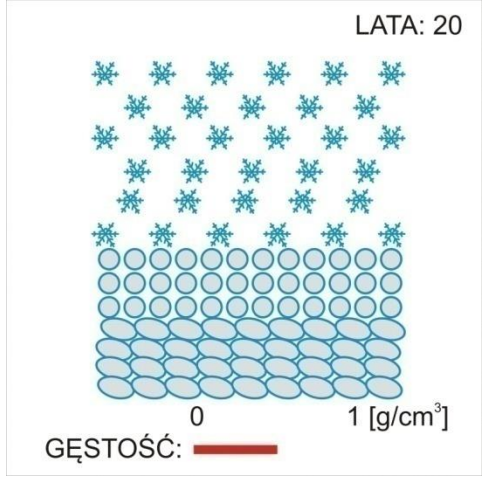
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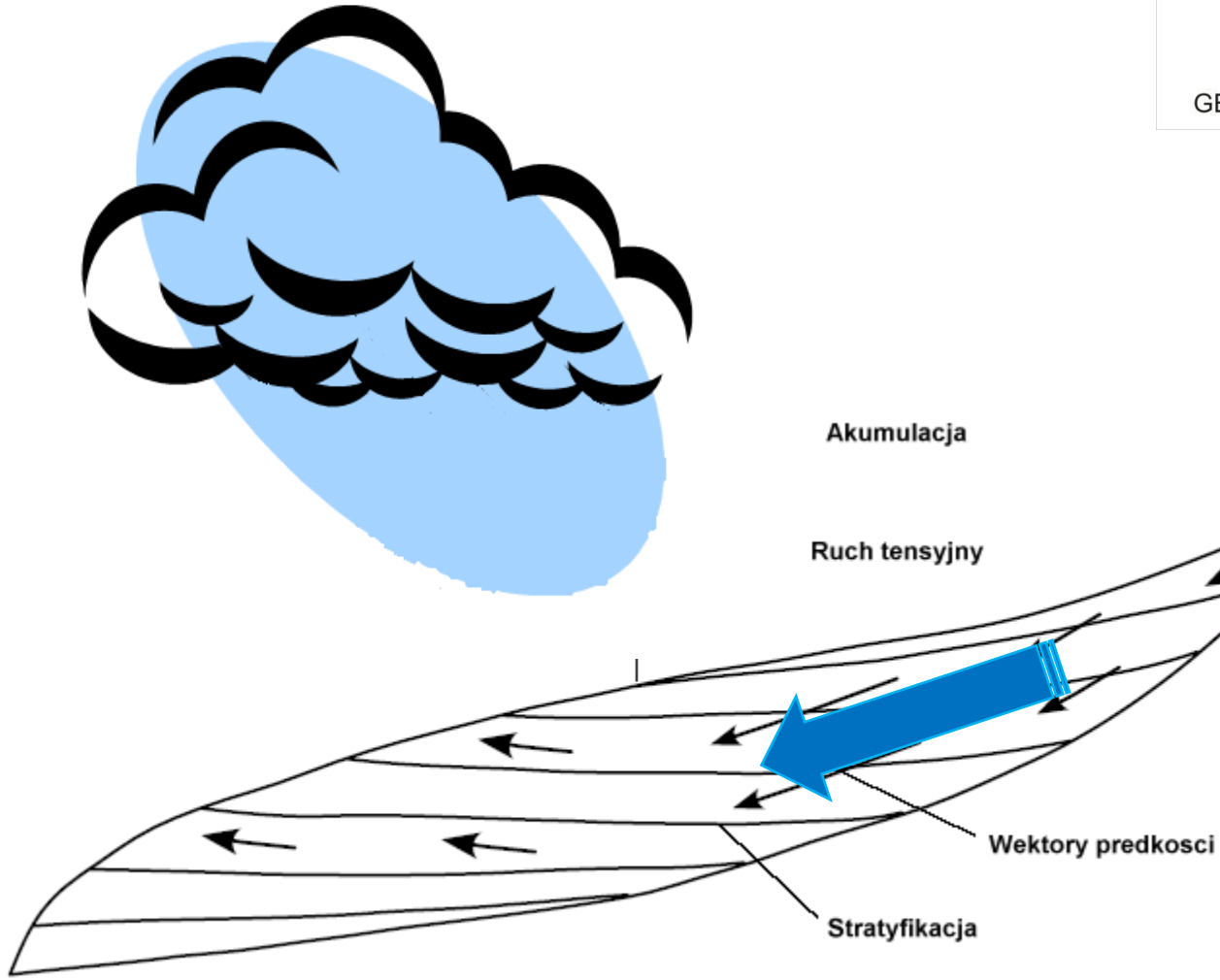
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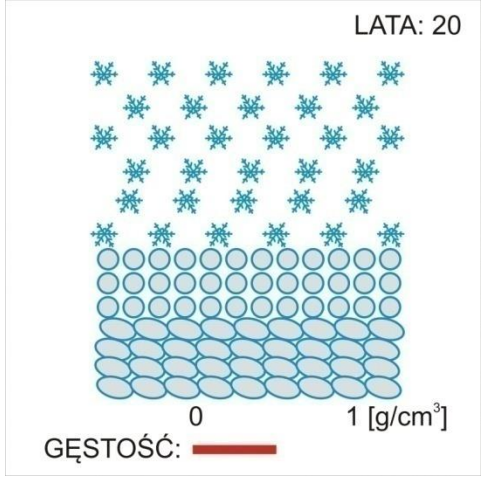
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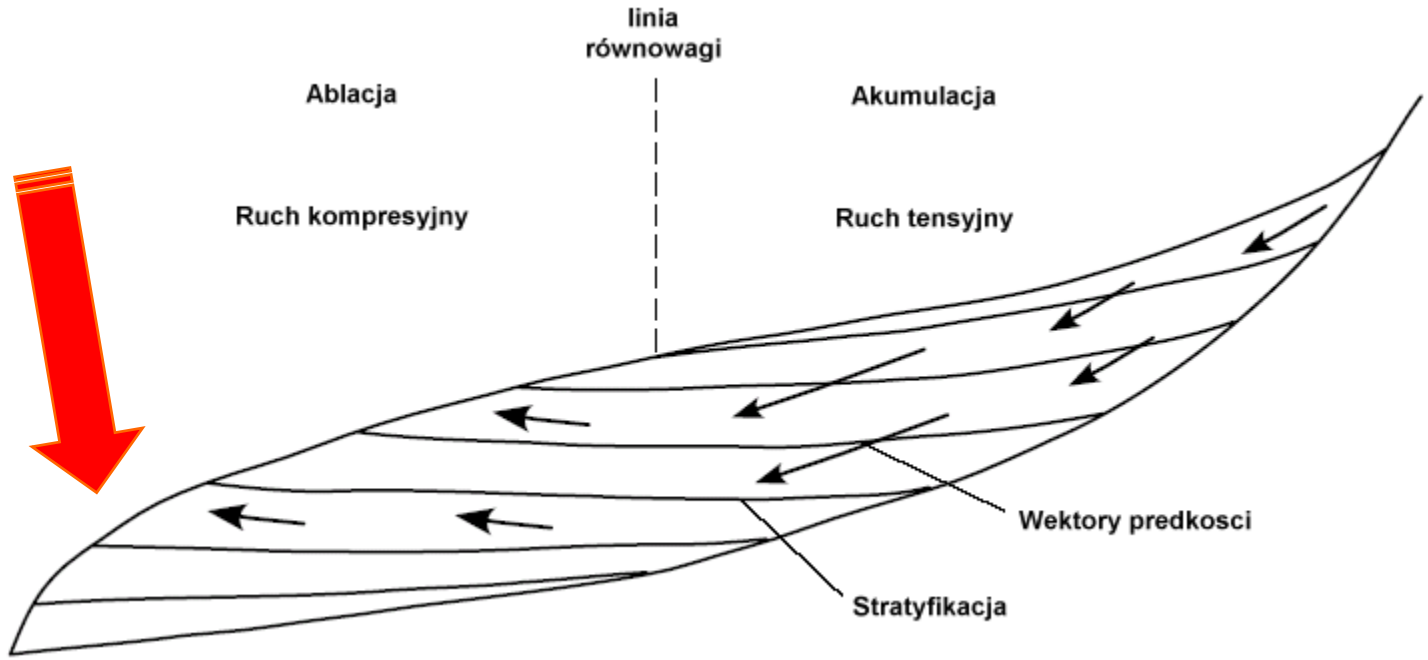
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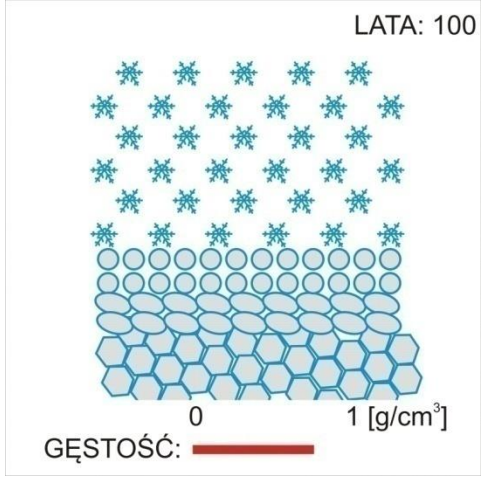
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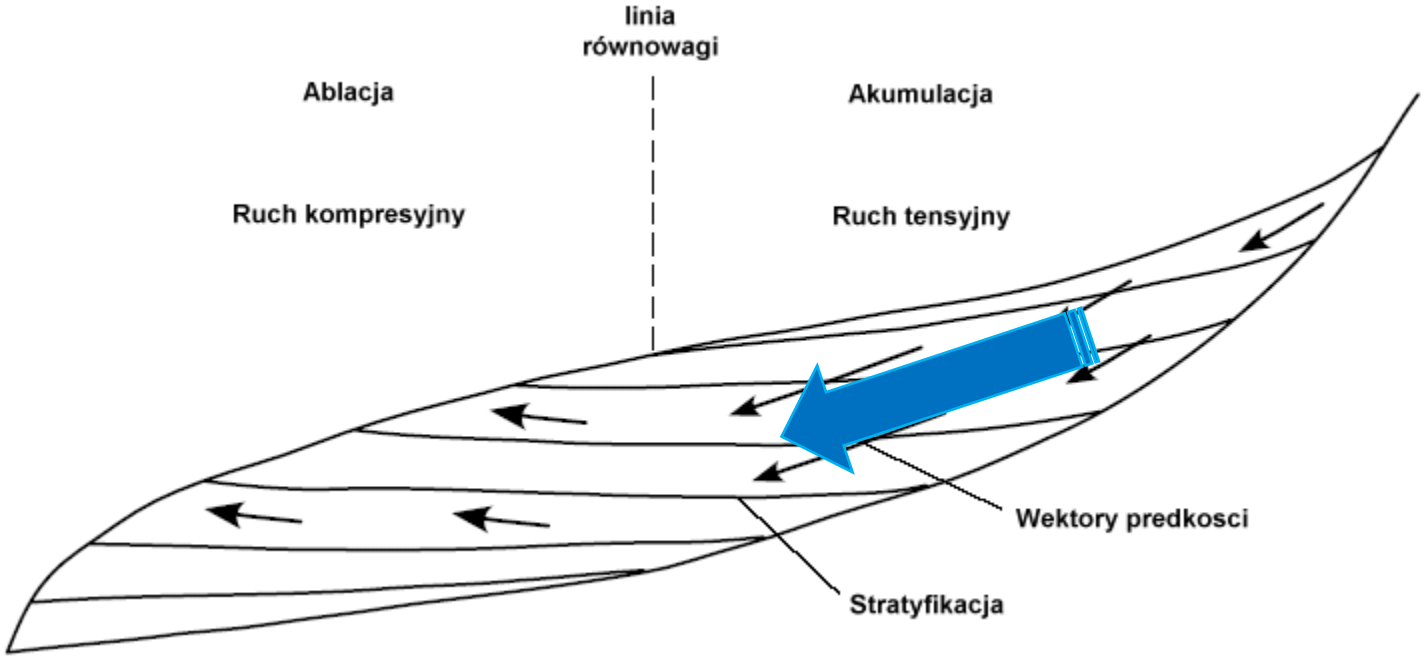
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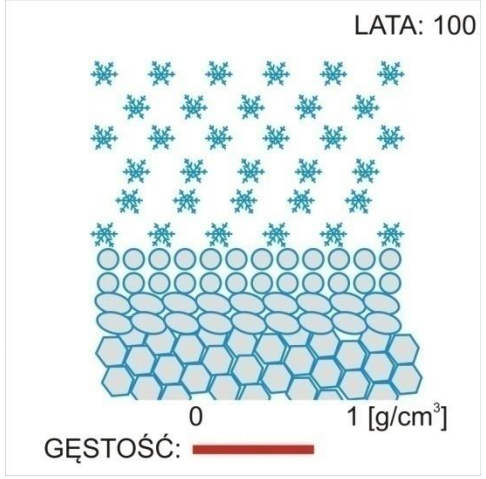
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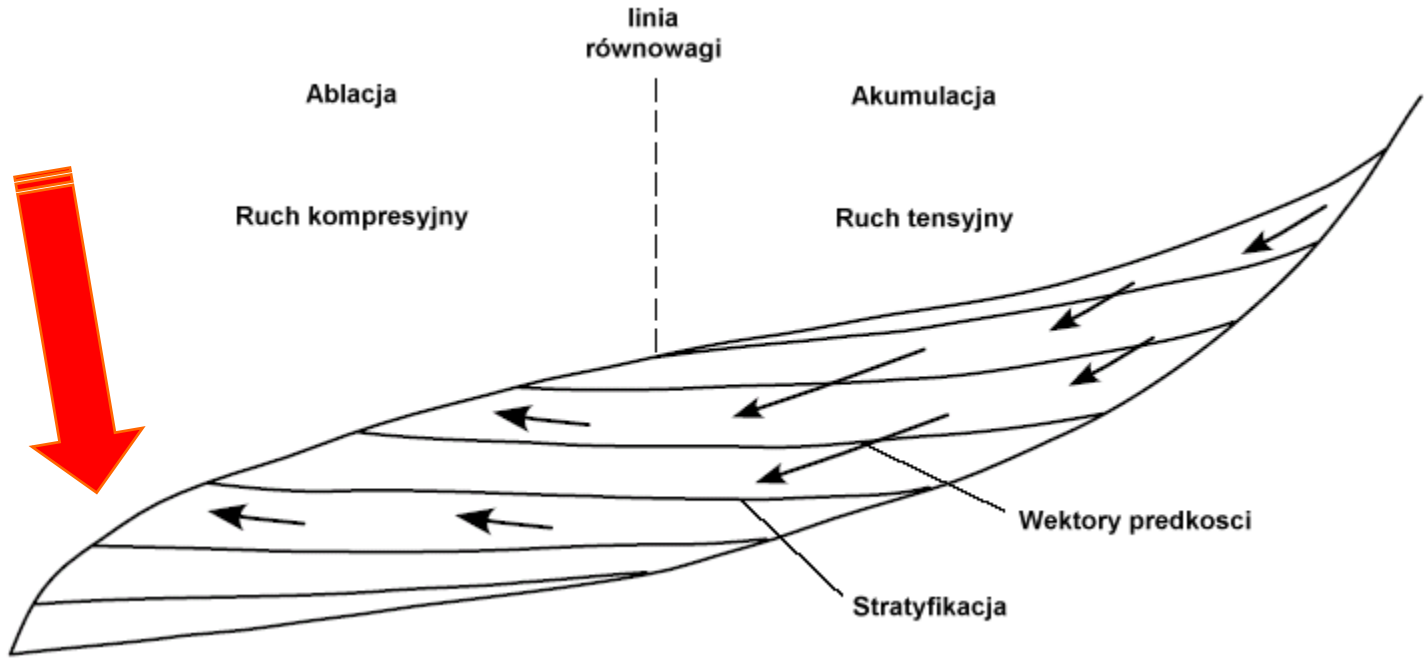
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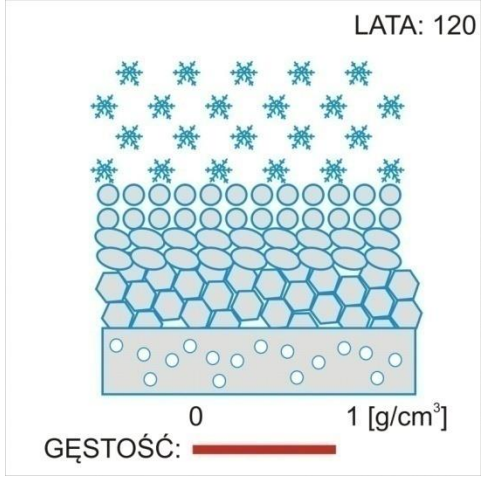
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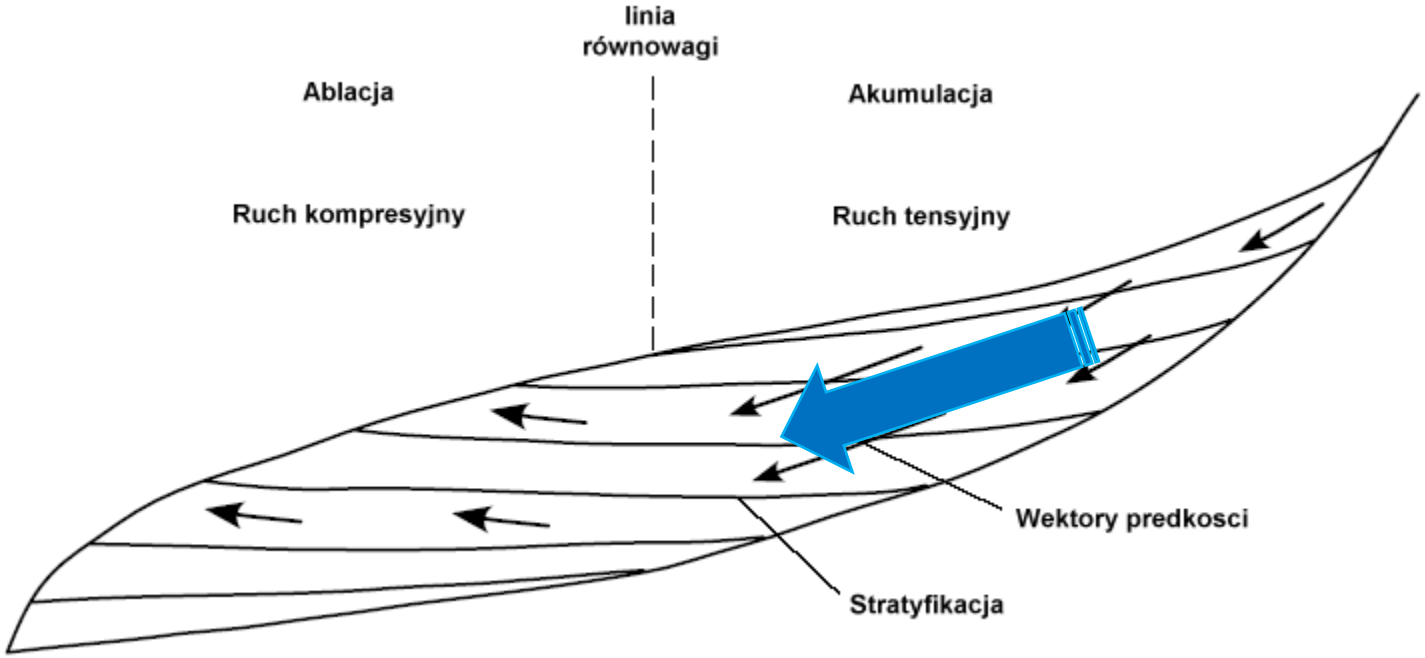
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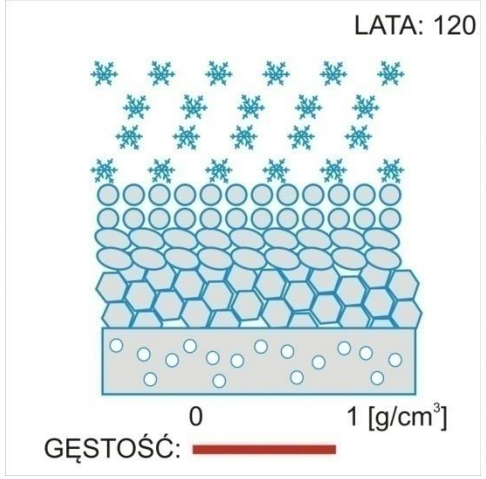
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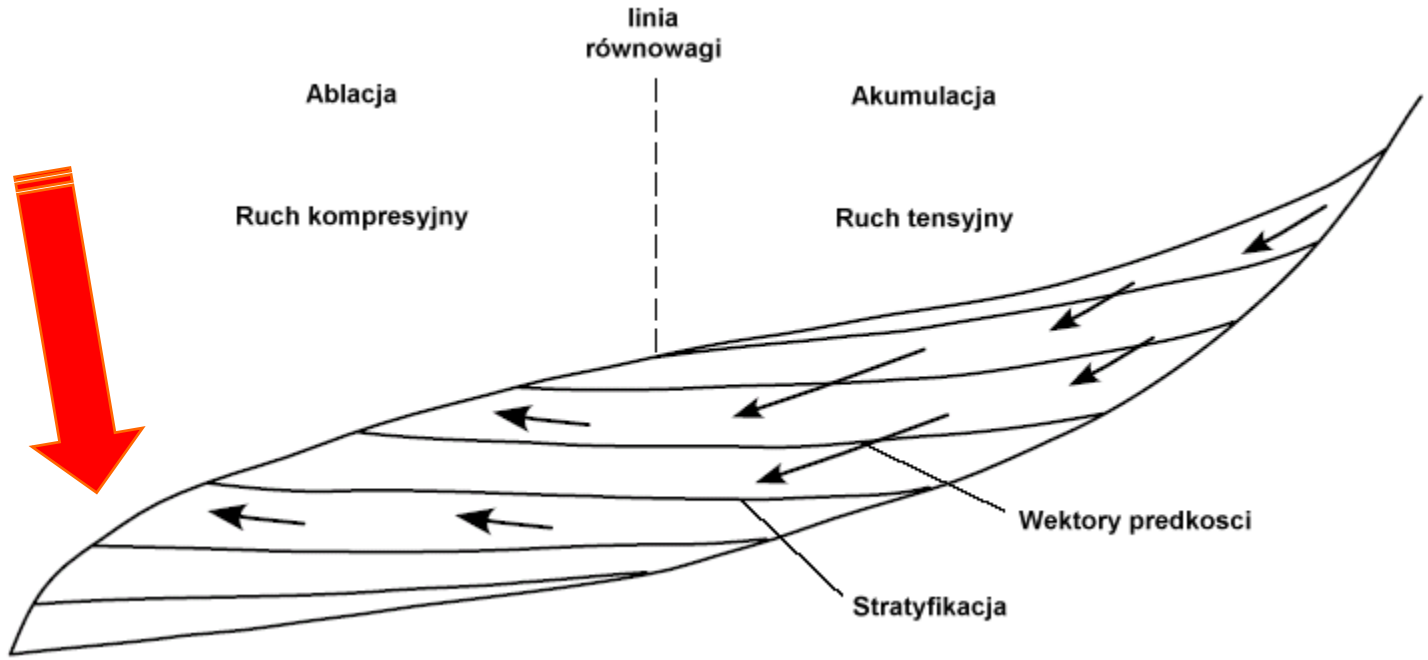
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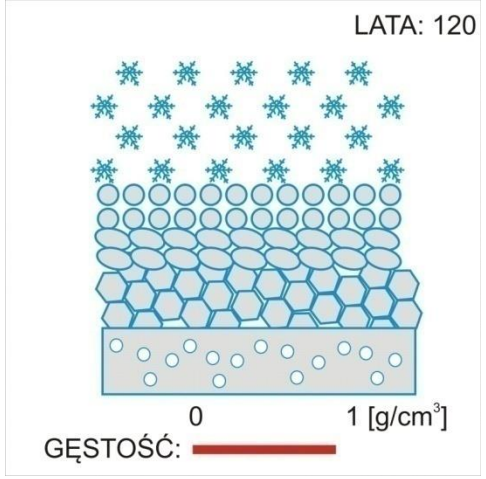
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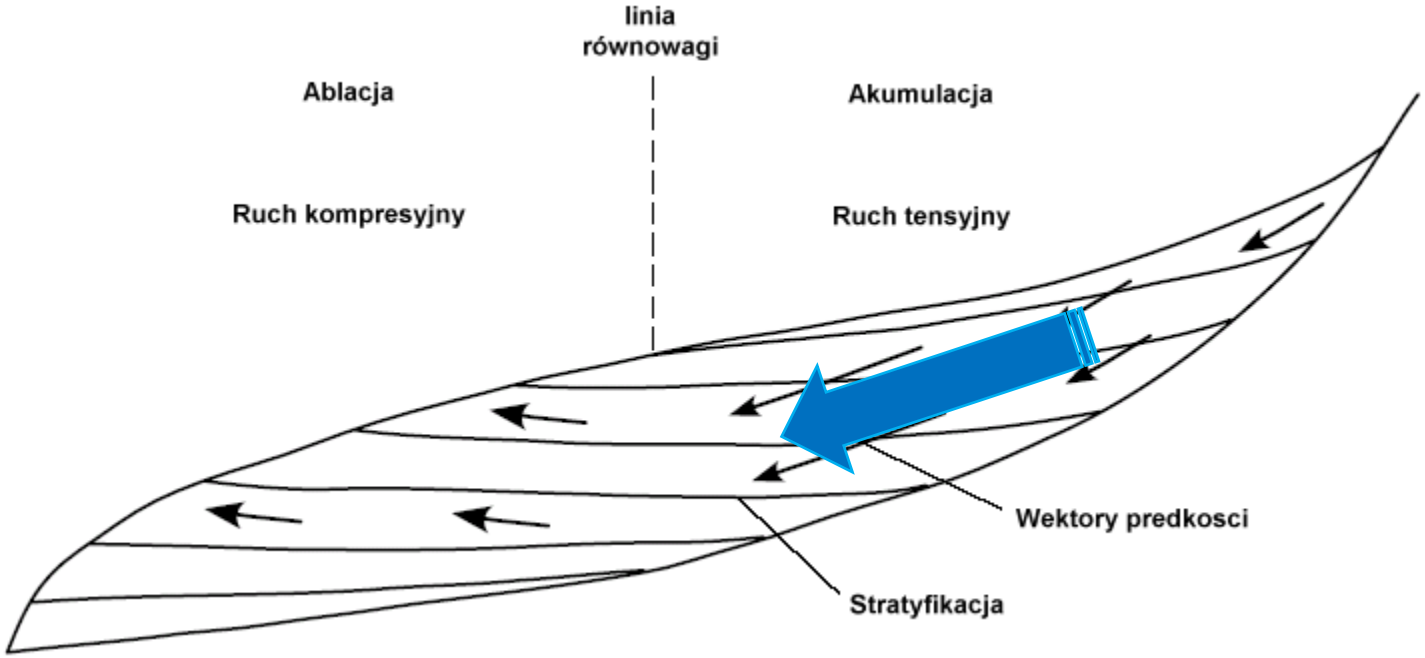
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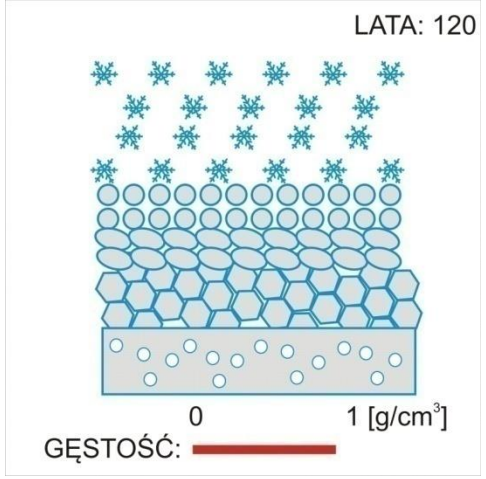
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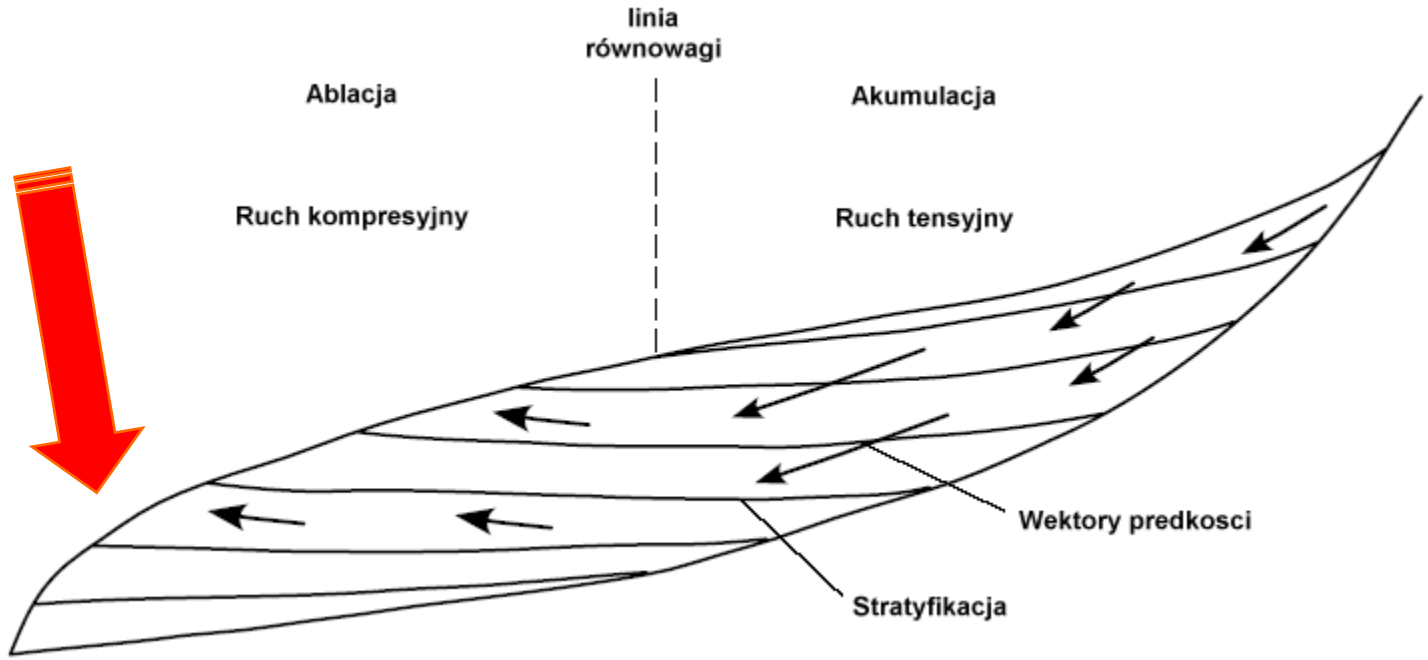
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Wektory predkosci
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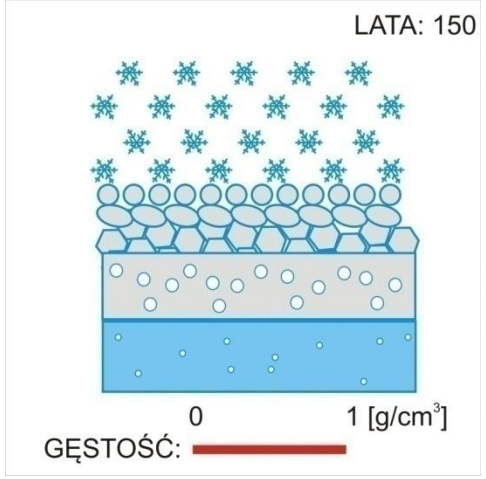
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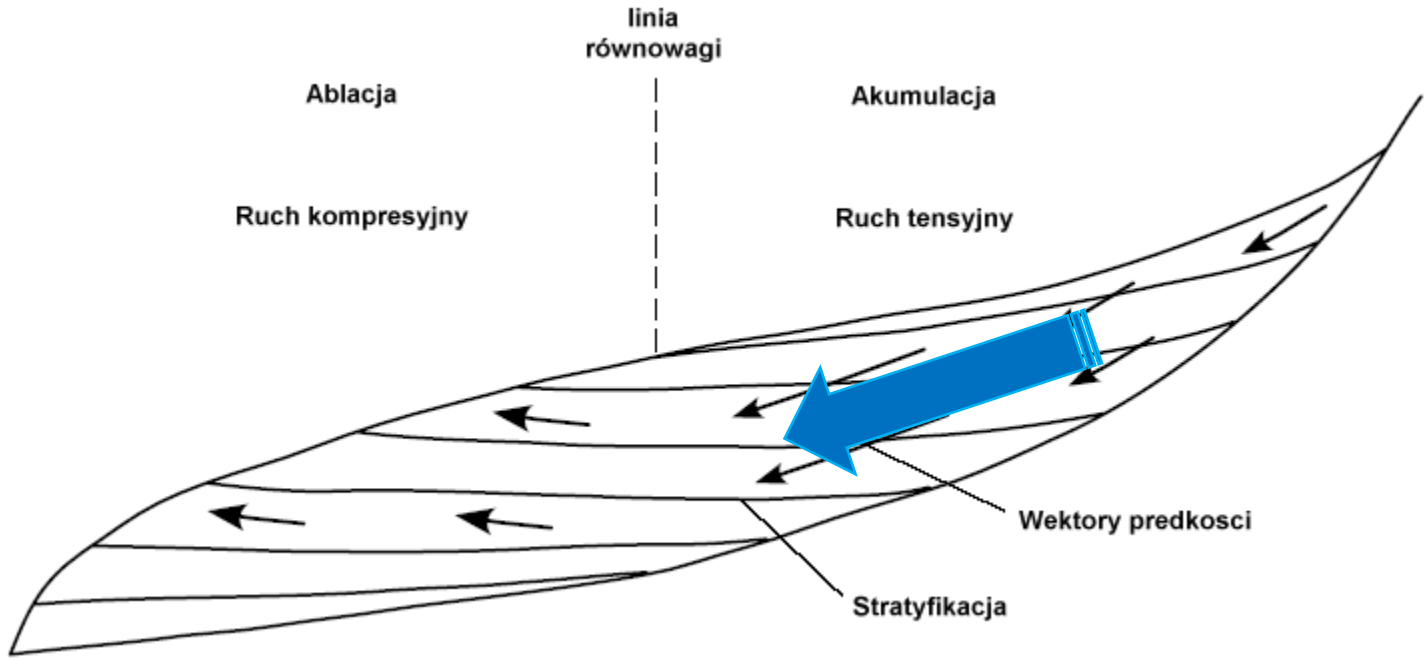
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Wektory predkosci
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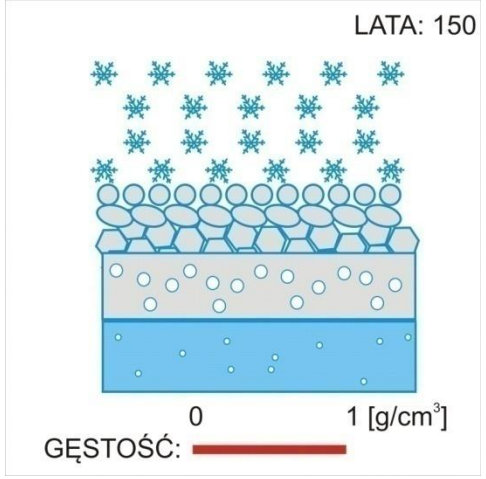
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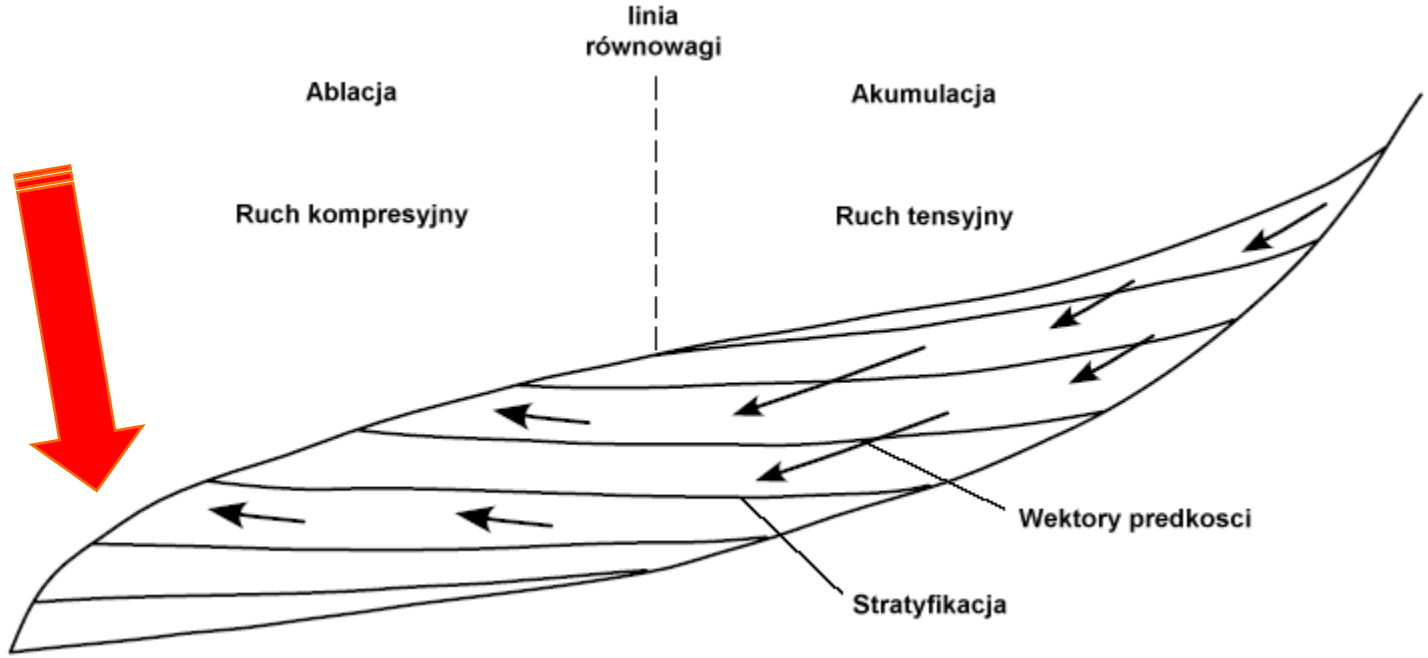
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Ablacja
Akumulacja
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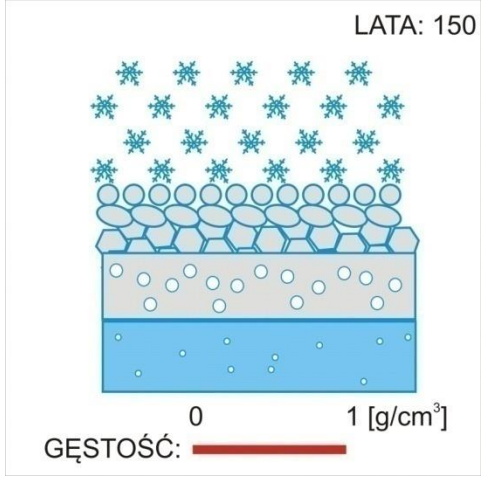
Ruch tensyjny
Wektory predkosci
Stratyfikacja


LATA: 150
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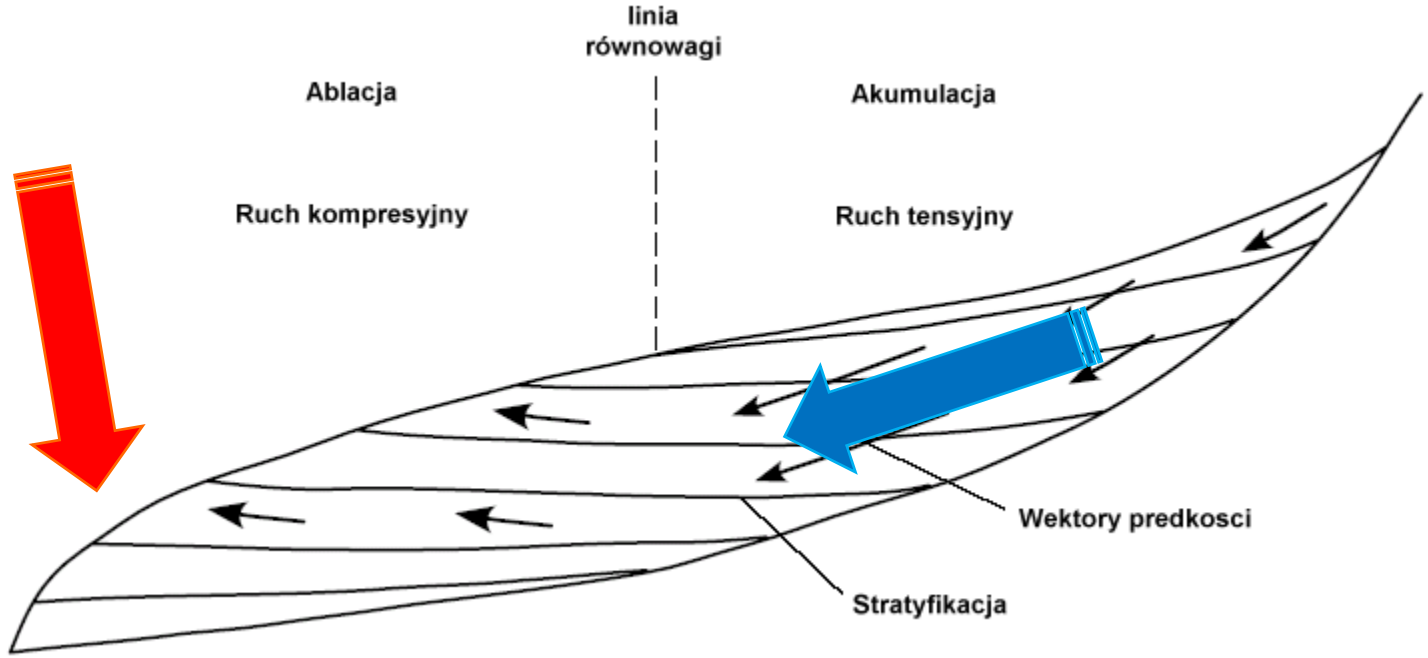
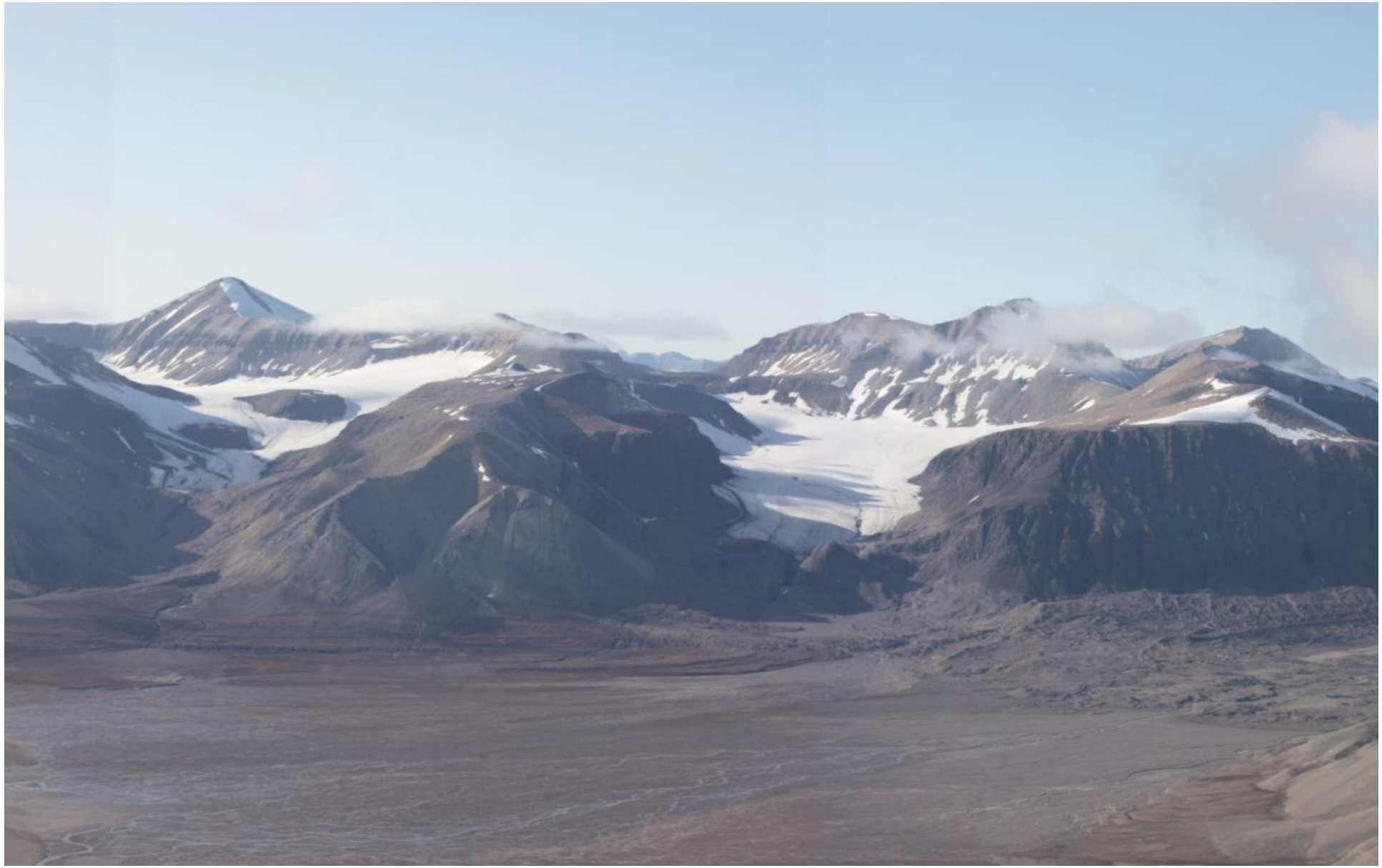
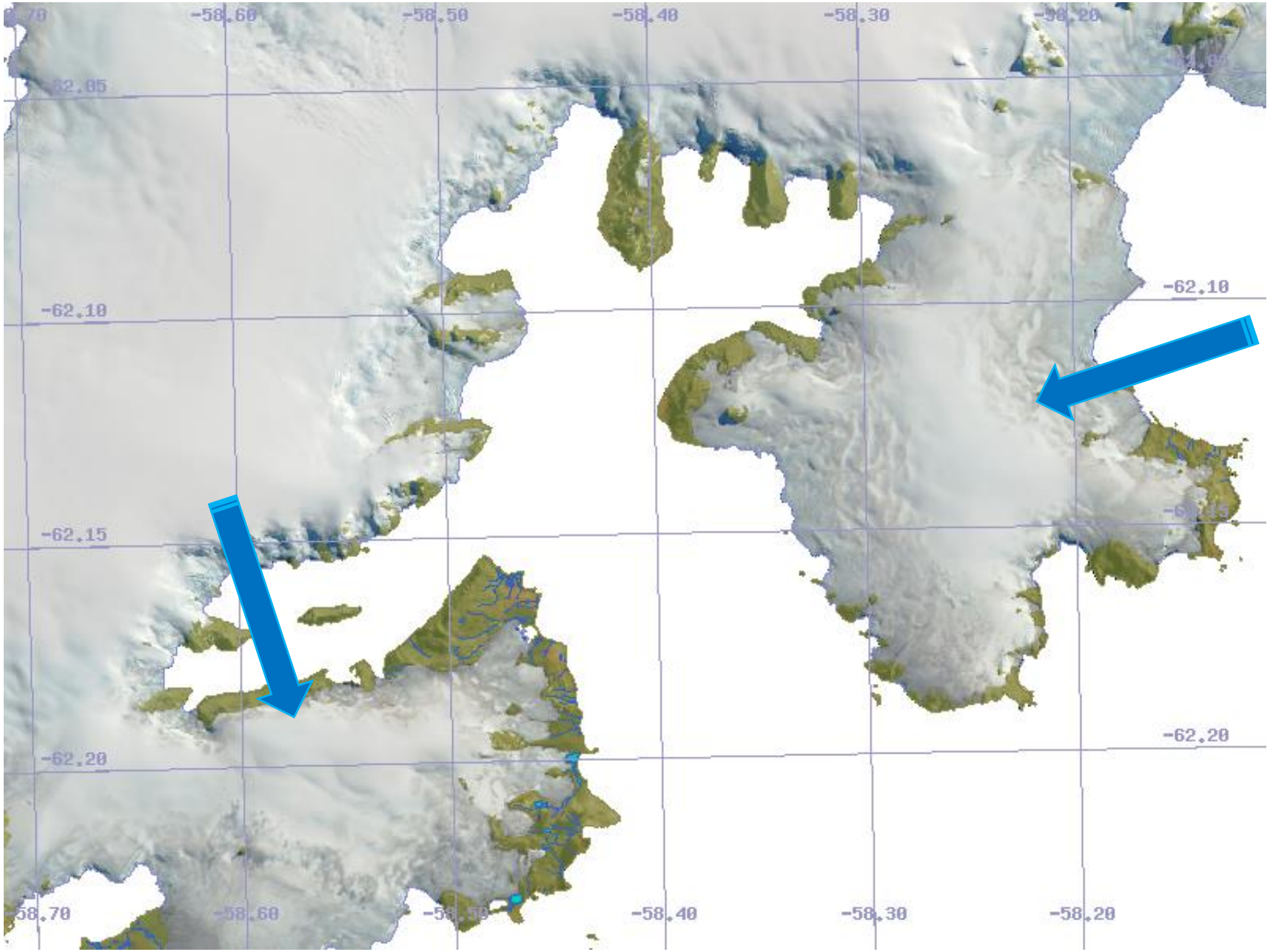
1 [g/cm^3]
GĘSTOŚĆ:


linia
równowagi
Ablacja
Akumulacja
Ruch kompresyjny
Ruch tensyjny
Wektory predkosci
Stratyfikacja

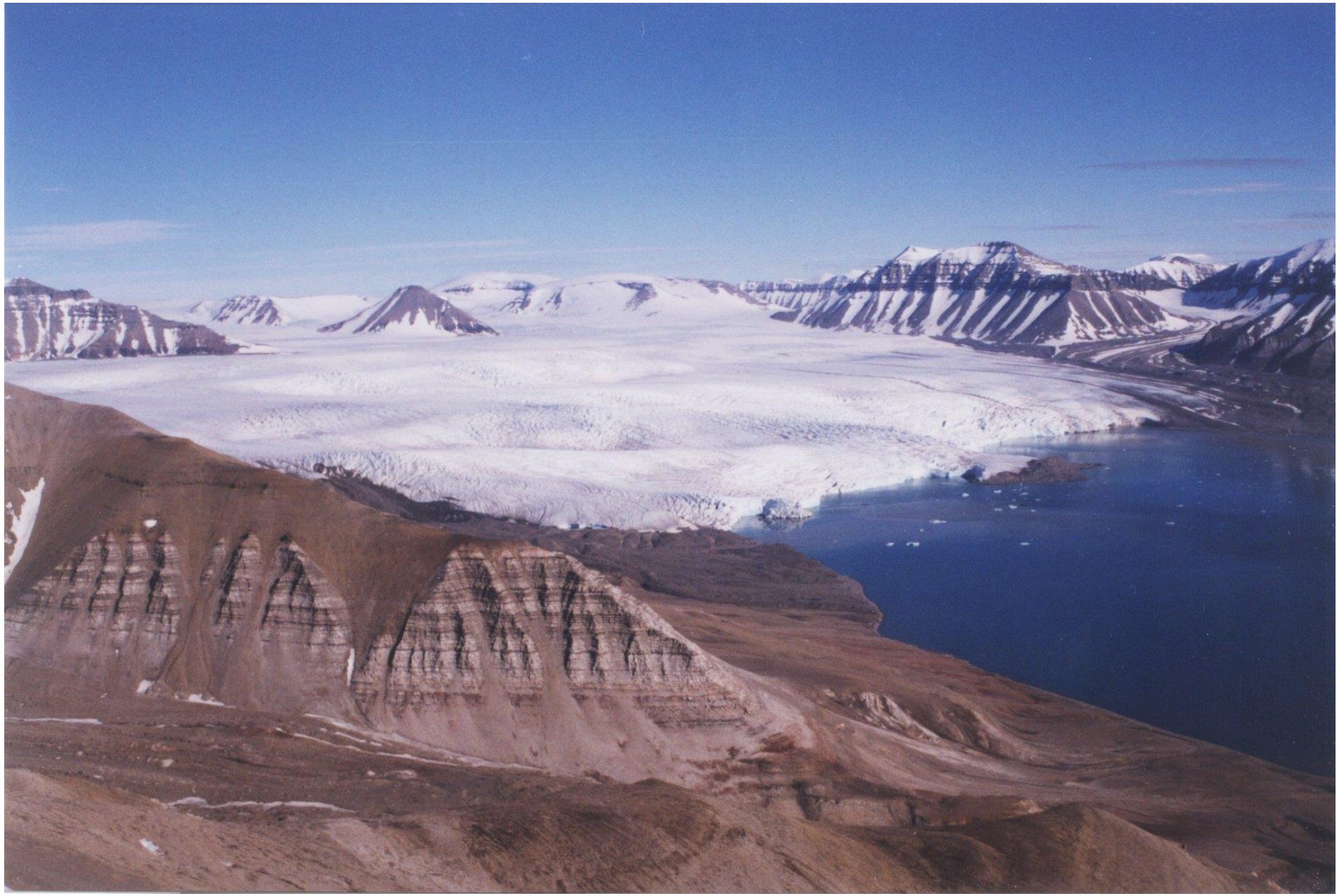

akumulacja
ablacja



Lodowce dolinne – Lodowce Ferdinand i Sven, Spitsbergen



Kopuły lodowe – Wyspa Króla Jerzego, Szetlandy Południowe



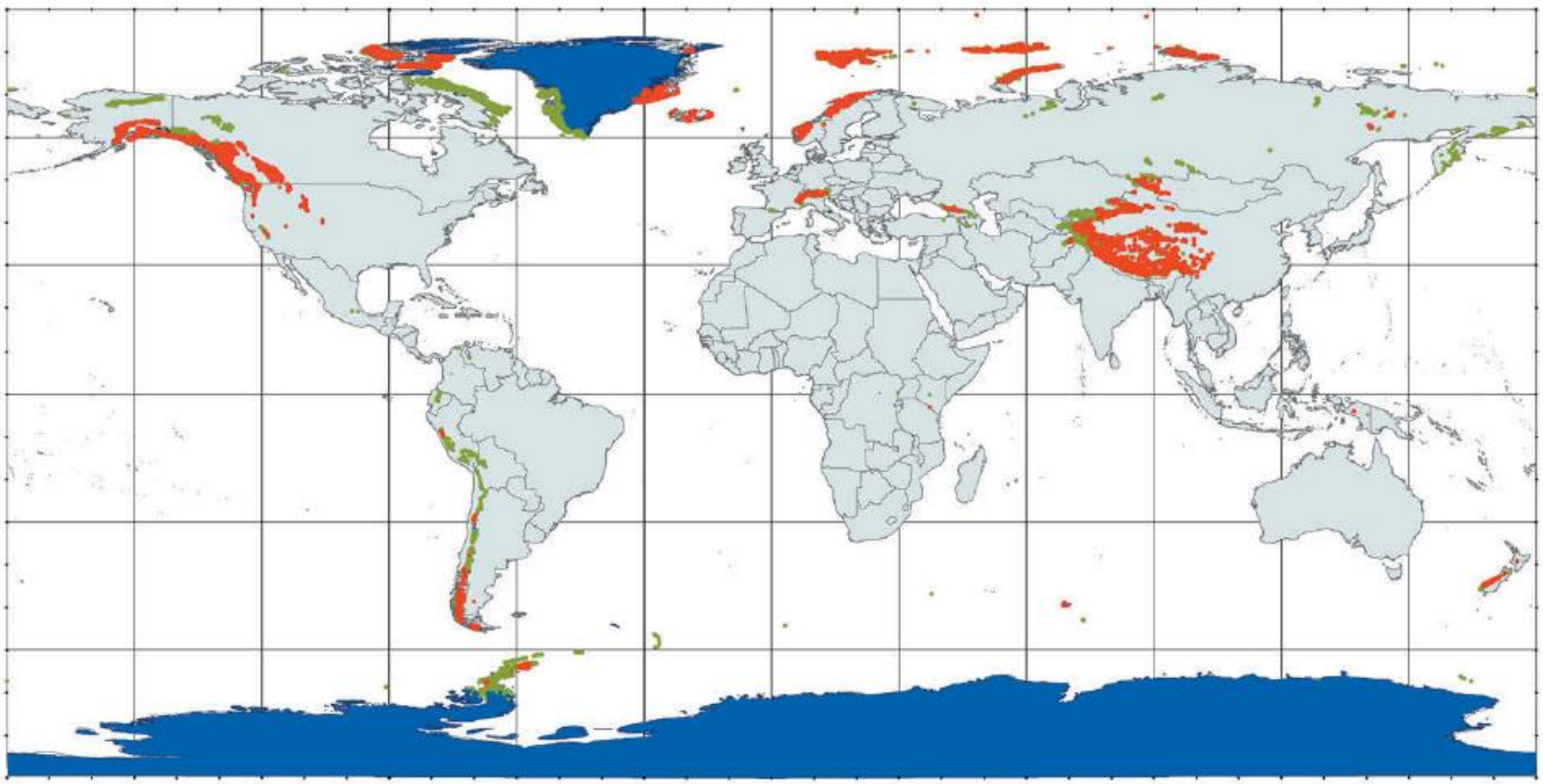
Lodowiec wypustowy schodzący do morza – Lodowiec Nordenskjolda, Spitsbergen

Lodowiec schodzący do morza – klify lodowe na Wyspie Księcia Karola

By Eric Gaba (Sting - fr:Sting)translation: Khan Tengri (talk) CC BY-SA 3.0

By Dave Pape - own work, using Blue Marble data, Domena publiczna

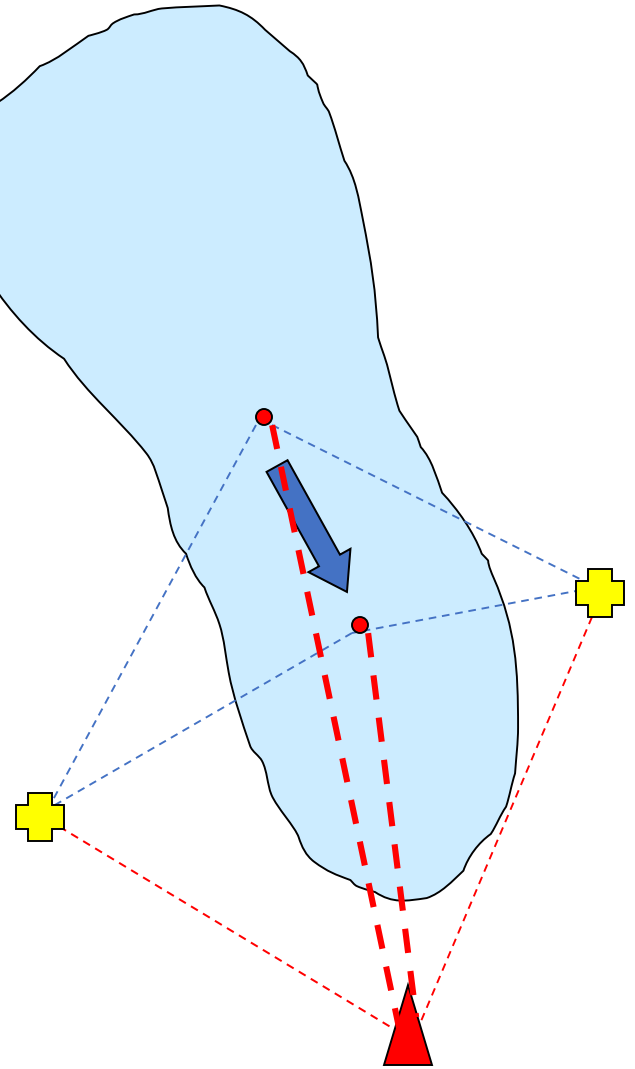
ROZMIESZCZENIE LODOWCÓW I LĄDOLODÓW NA KULI ZIEMSKIEJ

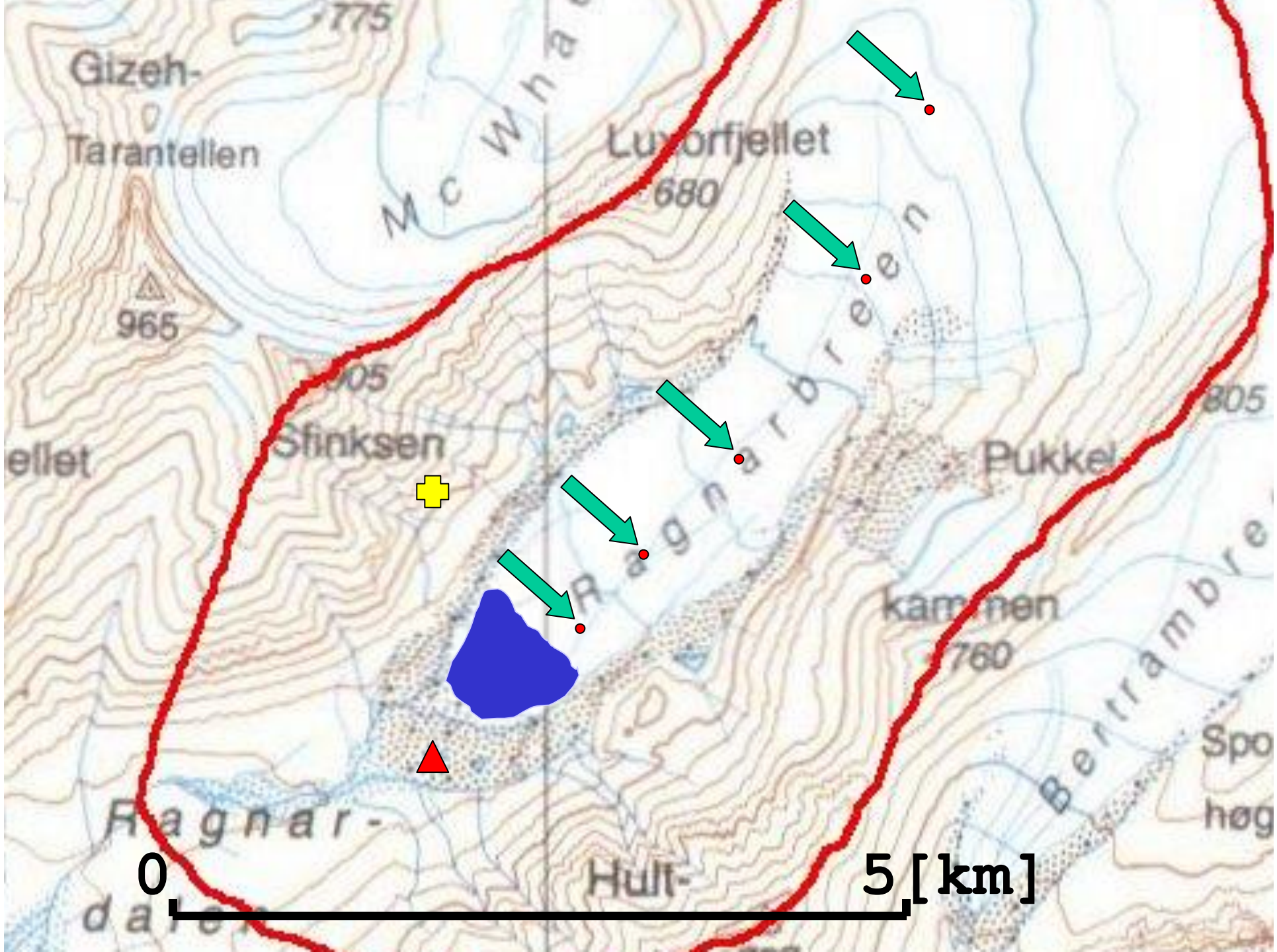


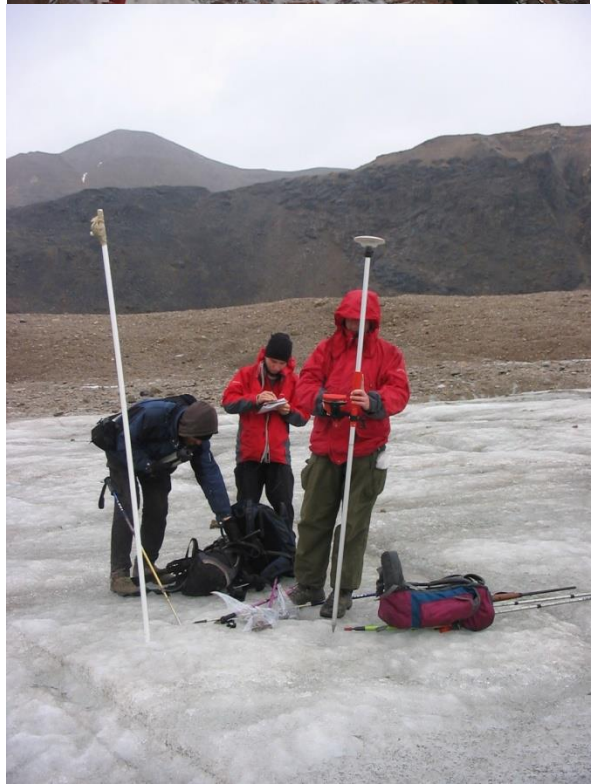
Zemp i in. 2014

AWANS LODOWCA– (łac. *avantare)* – ruch naprzód

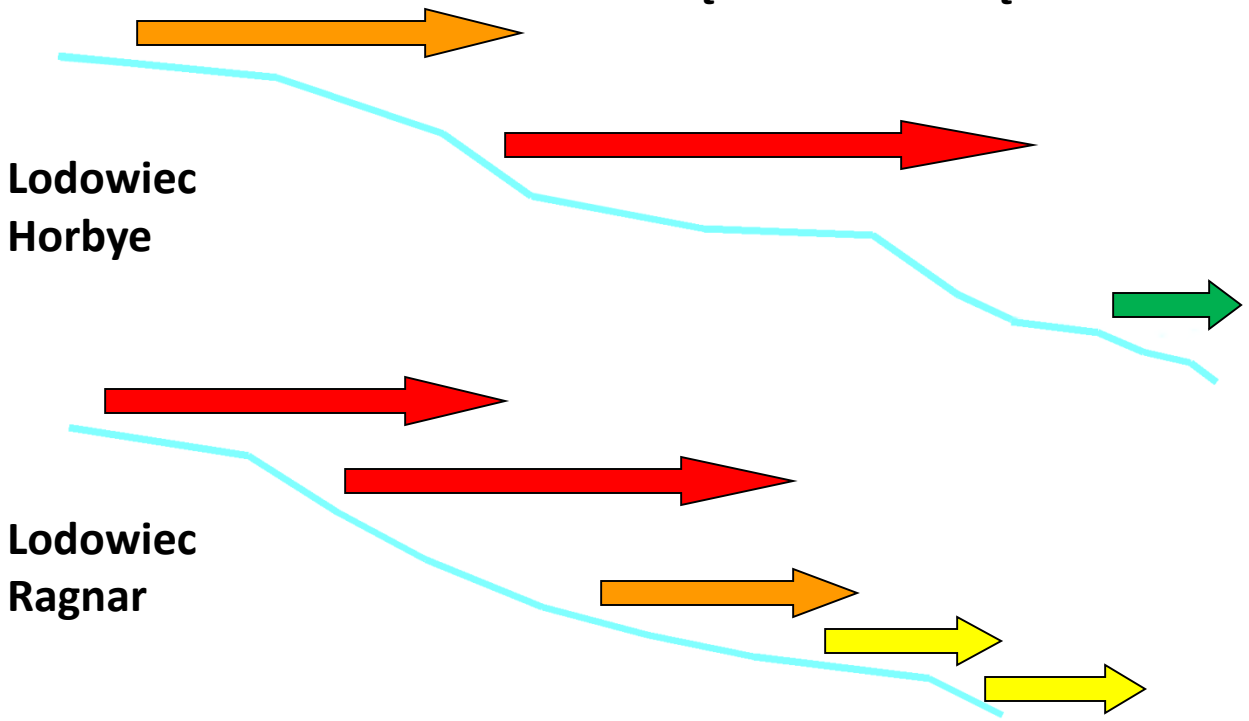
AWANS LODOWCA– (łac. *avantare)* – ruch naprzód




Gizeh-
Tarantellen
775
965
680
805
Sfinksen
ellet
Pukkel
kammen
760
Ragnarbreen
Ragnar-
dalen
Hult-
0
5 [km]



PRĘDKOŚCI PŁYNIĘCIA LODU



Rachlewicz (2009)

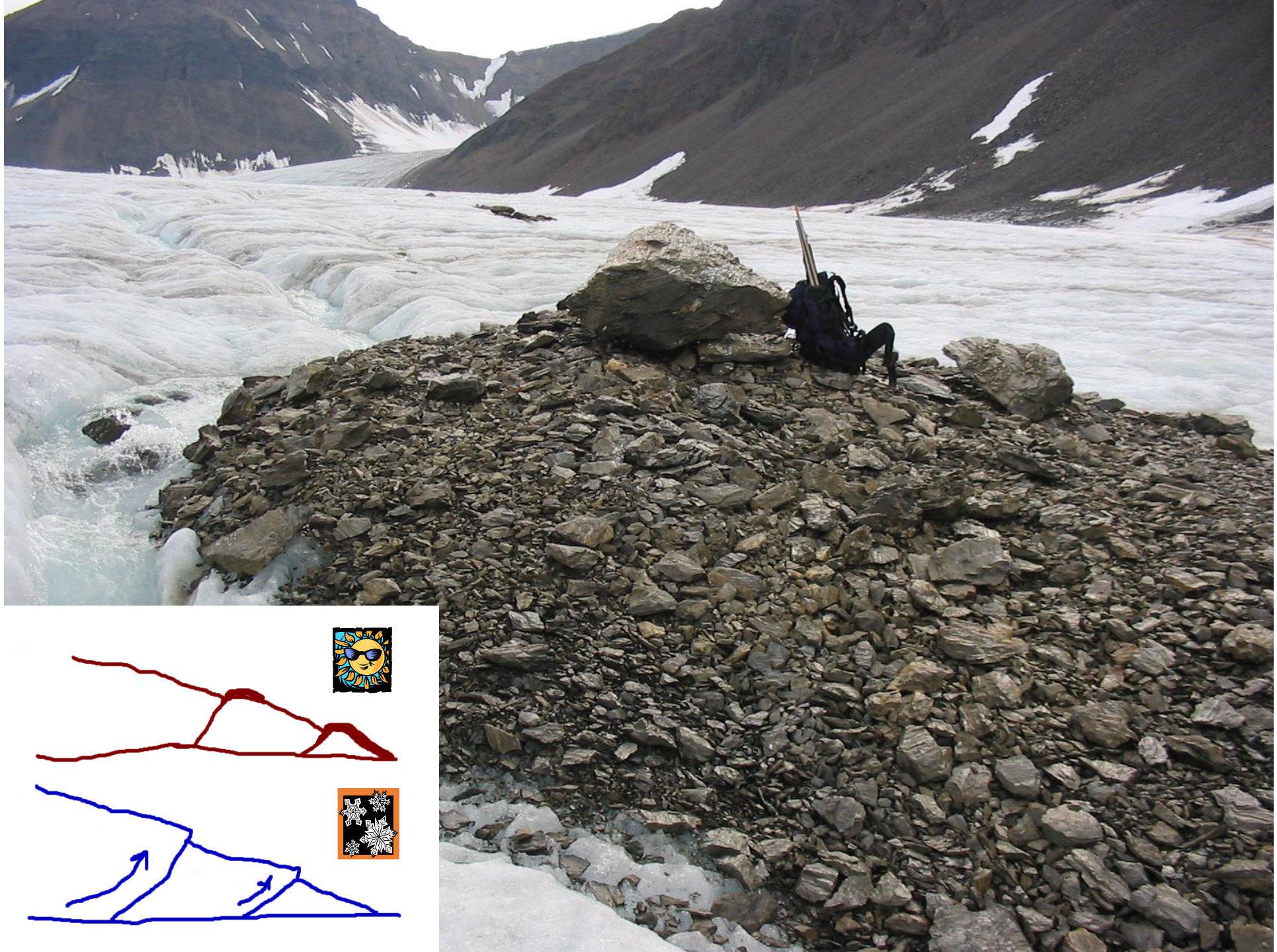
Szarża lodowcowa [*Glacier surge*]

Szarża lodowca Fridtjof, Bellsund, Spitsbergen 1996. Mike Hambrey (Glaciers online – swisseduc.ch)


Goncalo Vieira 2002

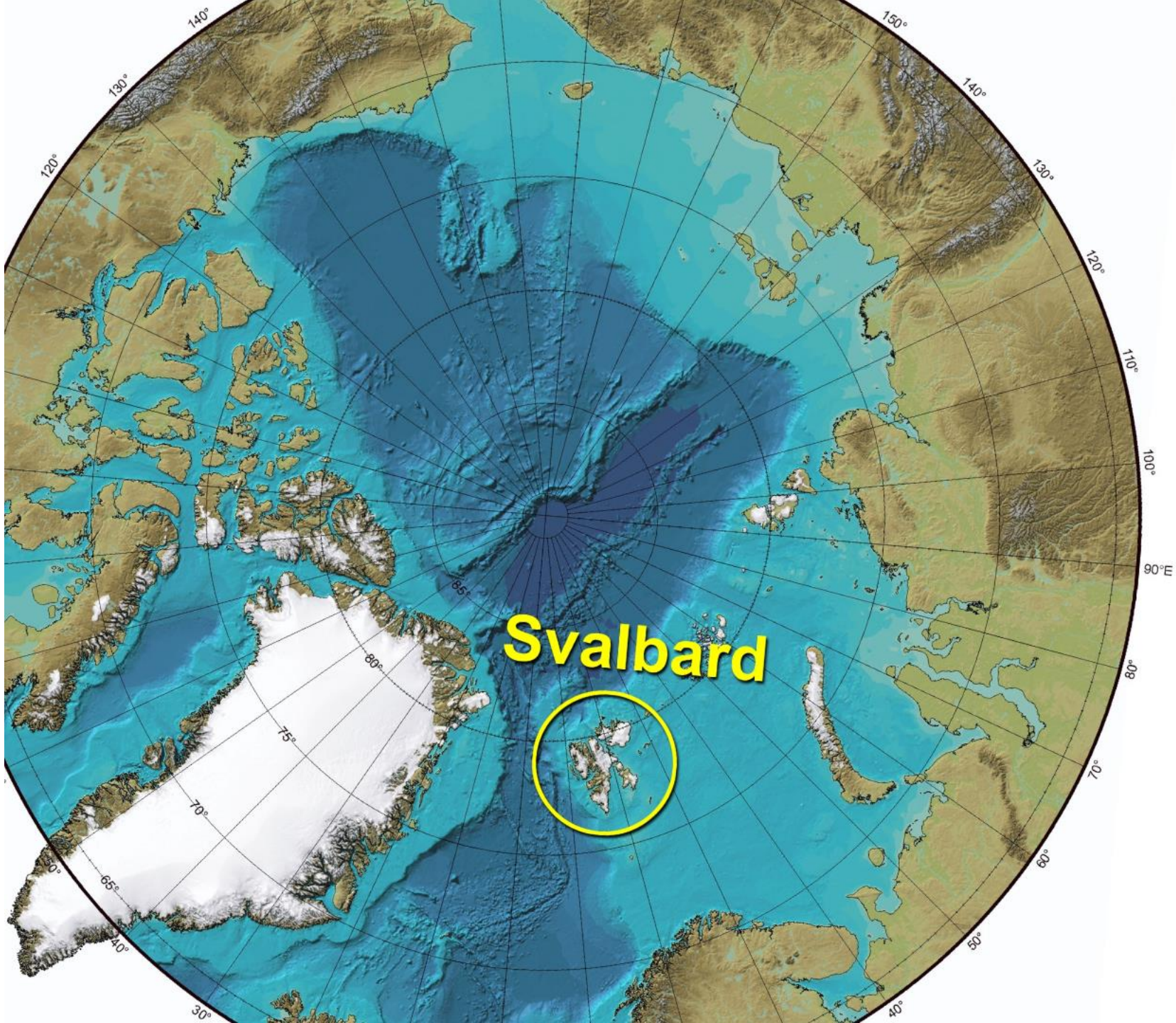
RECESJA – (łac. *recessus)* zmniejszanie się, ruch wsteczny, cofanie

RECESJA – (łac. *recessus)* zmniejszanie się, ruch wsteczny, cofanie

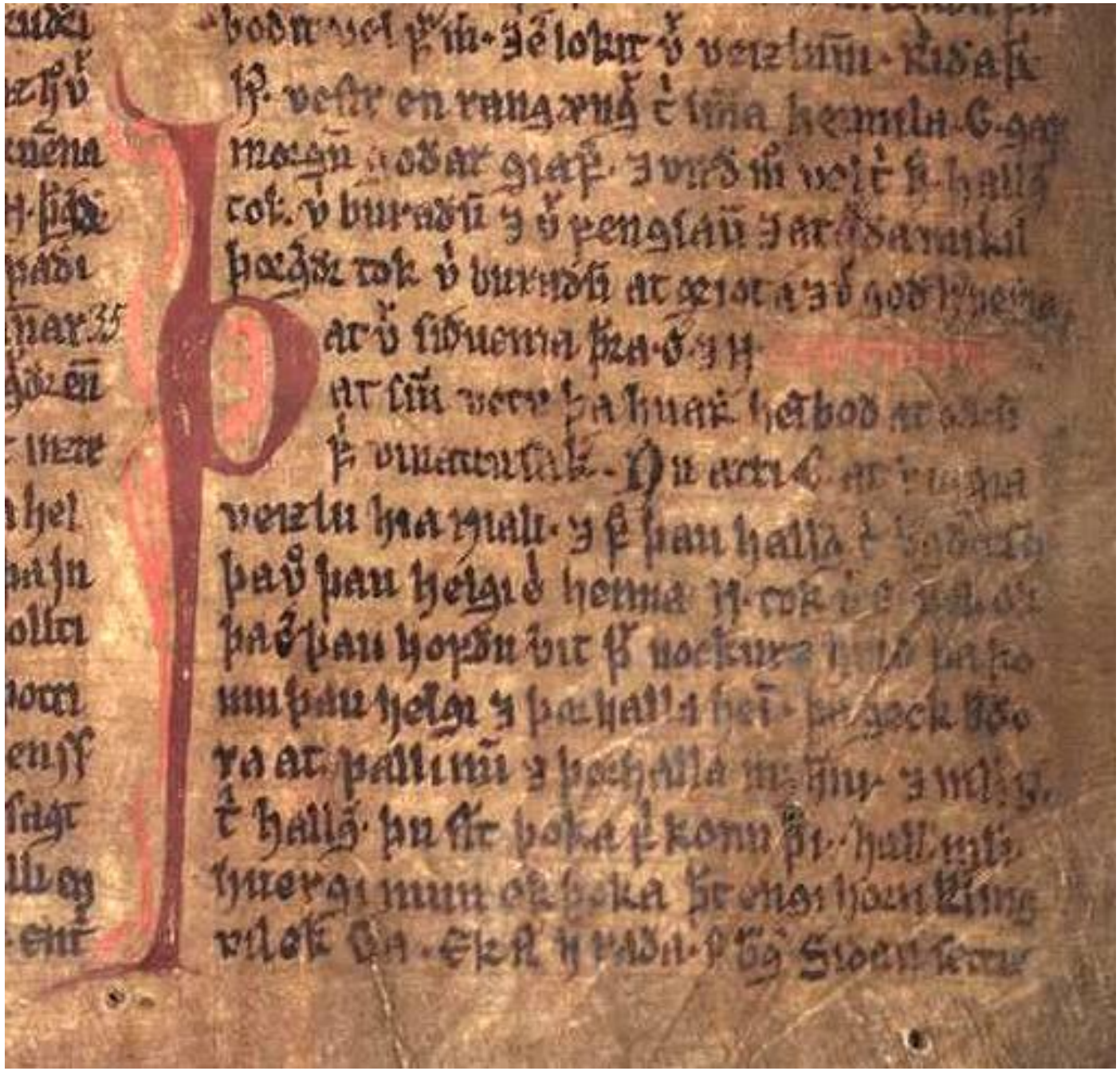



morena

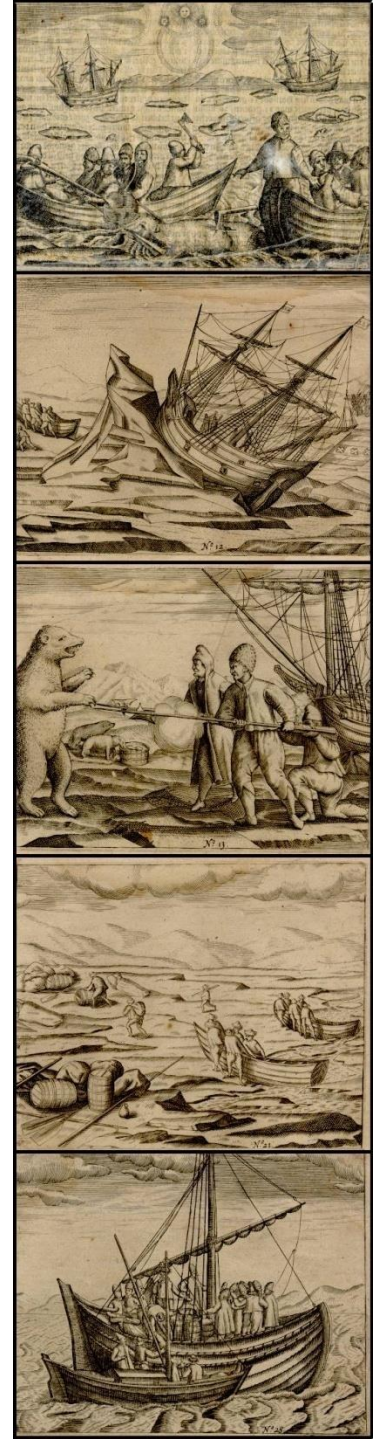

sandr


Svalbard
90°E


Svalbard Lufthavn
Longyearbyen
78° 15'N - 15°
Sydpolen 18692 km
New York
5581 km
Hamburg
3326 km
Paris
3 km
Vaasa 1689 km
Moskva
Roma
4052 km
km
3043 km
London

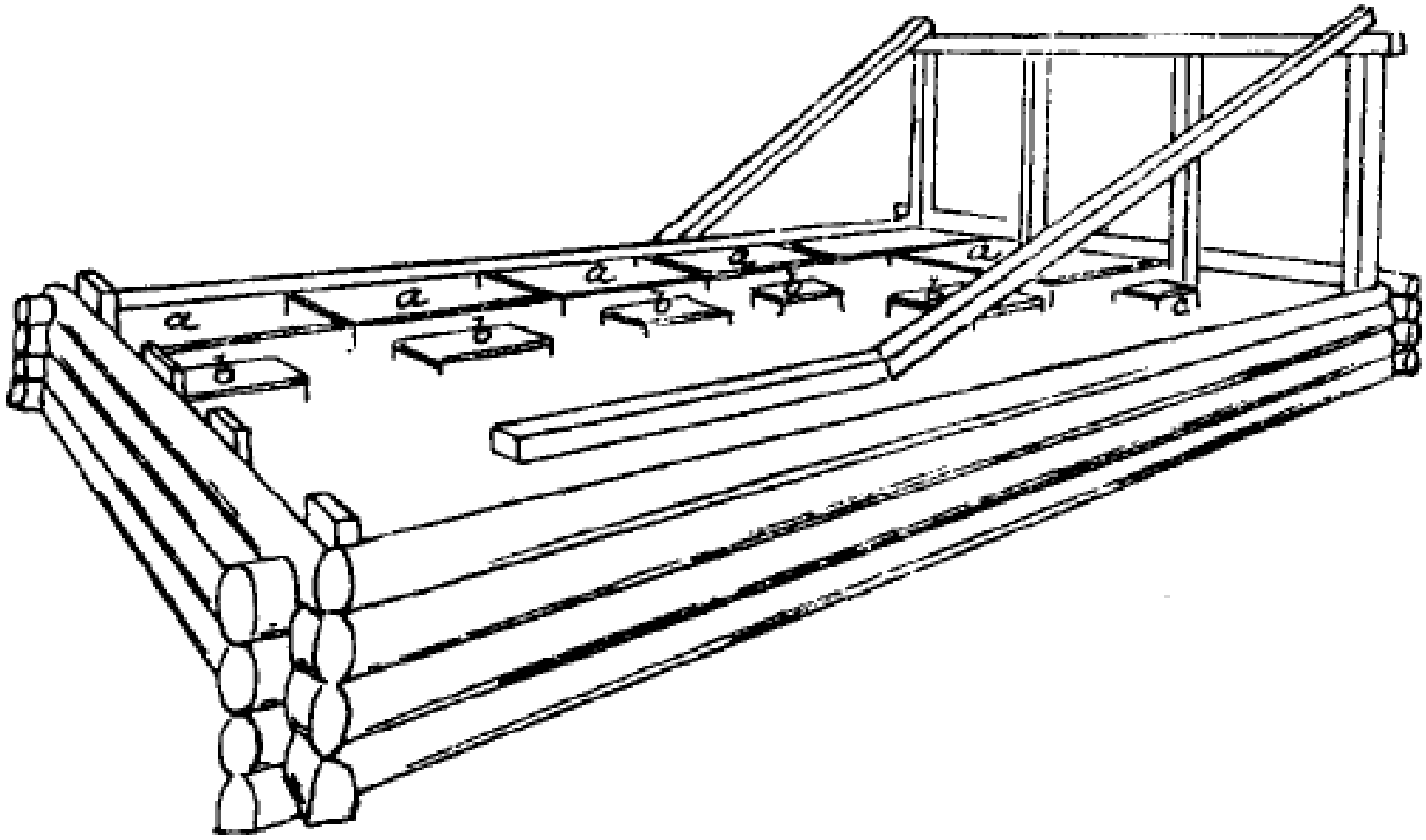


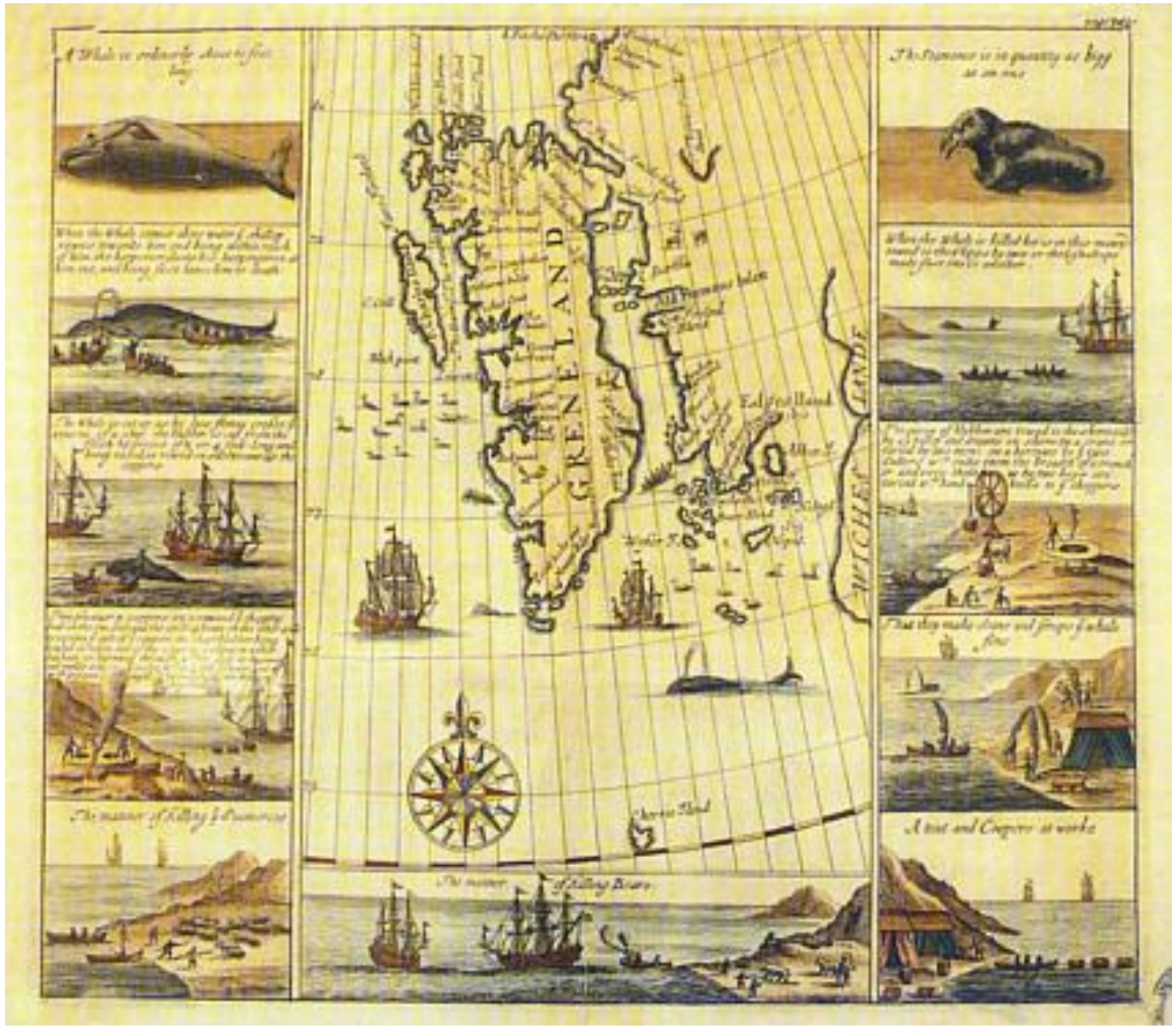
~1550 – 20.06.1597



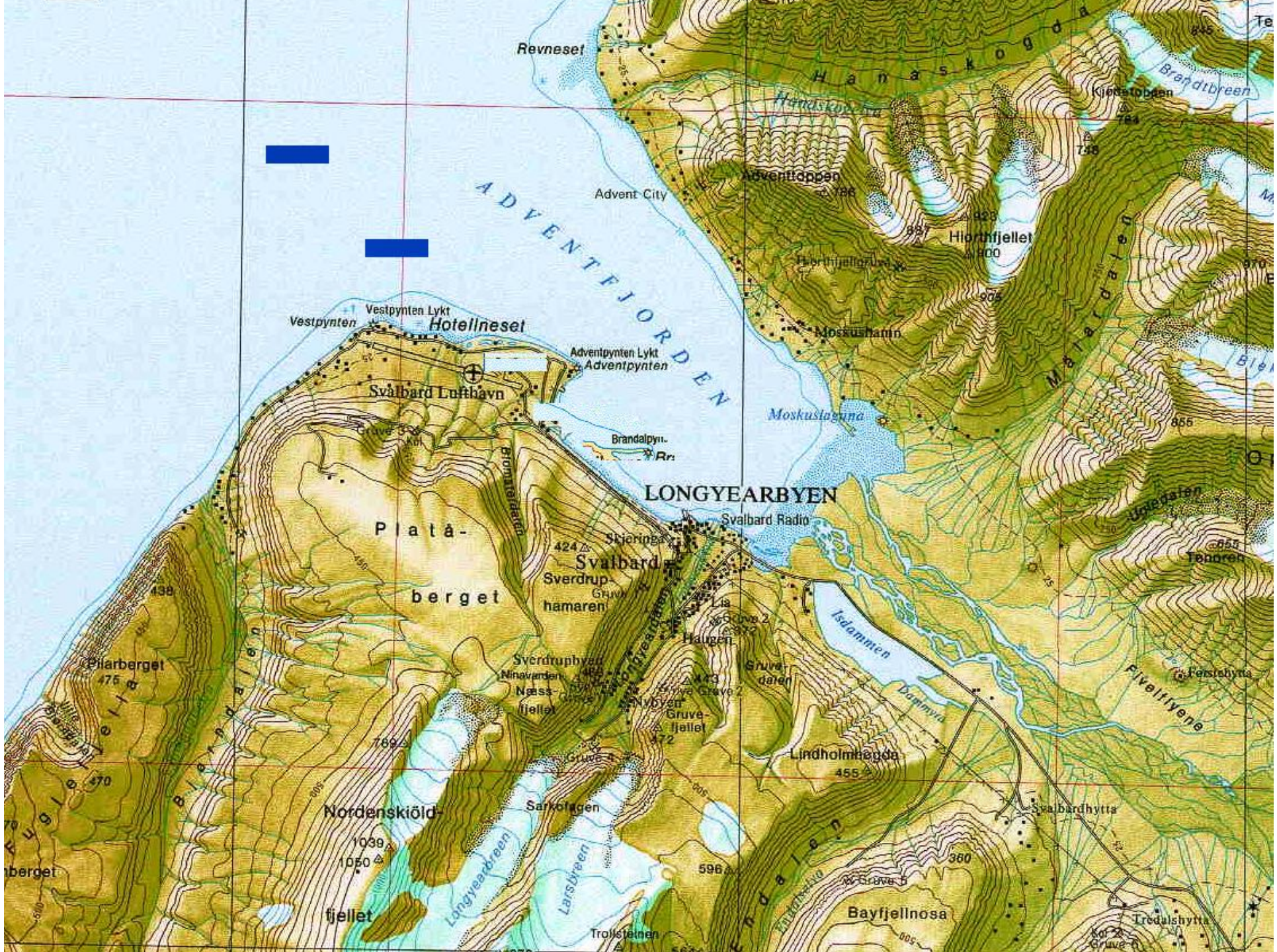

N° 13


FRETUM DAVIS
ESTOTILAND
GROENLAND
GROENLAND
BERGI REGIO
ESTRECHO DE ANIAN
POLUS ARCTICUS.
Polus Magnetis
FRISLAND
ISLAND
Het nieuwe land
Circulus Arcticus
Faro Ins.
SCOTIA
NORVEGIA
SWEDIA
FINMARCHIA
LAPPIA
Oost Finland
Bothicus Sinus
MOSCOVIA
NOVA ZEM. BLA.
Samoieda
Condora
Picis
Sobiora
Ingora
TARTARIÆ PARS.
Obdora
Molgomzaia
SOMER ZEE
Tarcas
Capo de Tabin.
Bargu.
Mongul
Tain gin.
Caro co ram.
I. Tafata
Cavona
Colmac
BAIDA
Ong


a
a
a
a
a
b
b
b
b
b
b



1625


Revneset
Hanaskogda
Kjerstobben
764
Brandtbreen
Adventtoppen
Advent City
ADVENTFJORDEN
Hiorthfjellet
900
Hiorthfjellgruva
Moskushamn
Vestpynten Lykt
Vestpynten
Hotellneset
Adventpynten Lykt
Adventpynten
Svalbard Lufthavn
Moskuslaguna
Brandalpyn-
Bjørndalen
LONGYEARBYEN
Svalbard Radio
Platå-
berget
Skjeringa
424
Svalbard-
Sverdrup-
hamaren
Gruve 3
Kol
Lia
Gruve 2
Haugen
Isdammen
Fivelfryene
Ferstehytta
Sverdruphytta
Ninavarden
Næss-
fjellet
Nybyen
Gruve-
fjellet
472
Gruve 4
Lindholmhøgda
455
Pilarberget
475
Sarkofagen
Nordenskiöld-
1039
1050
fjellet
Longyearbreen
Larsbreen
Svalbardhytta
Bayfjellnosa
Trollsteinen
Tredalshytta
Kol
Gruve 6

2006

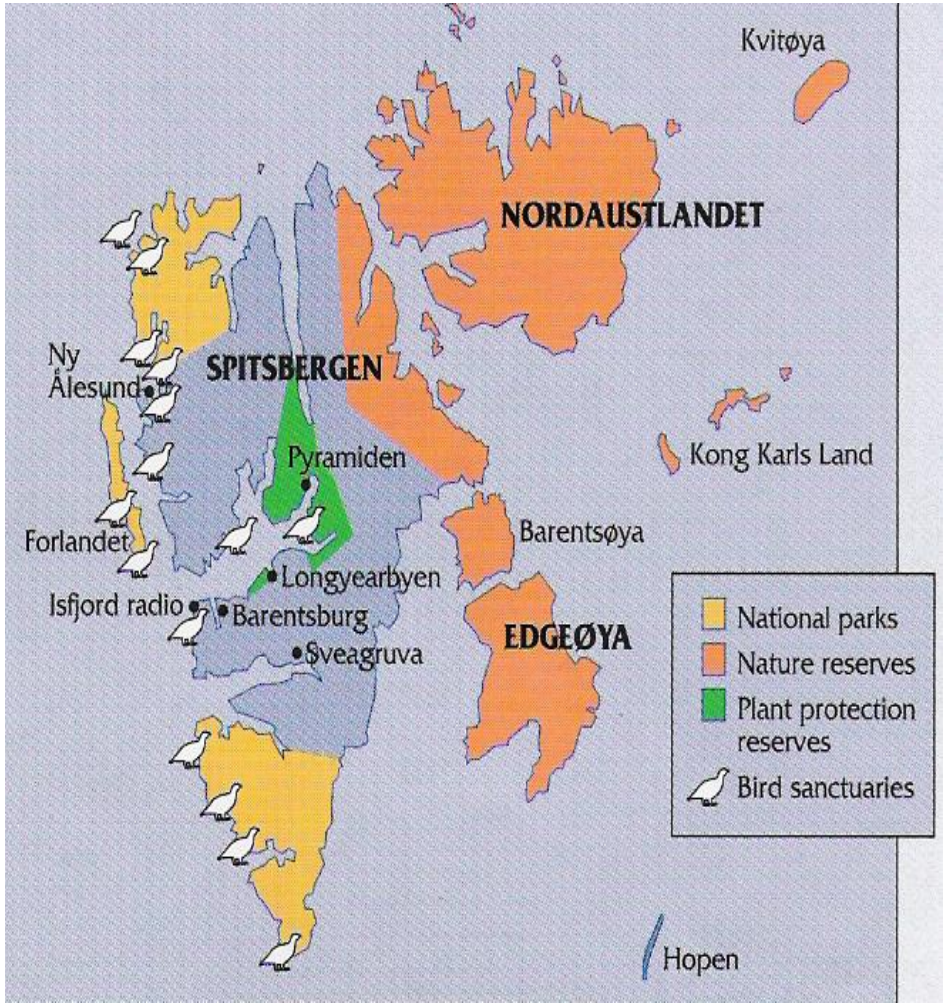

ПИРАМИДА


1972
М Е Х Ц Е Х


MAXIM GORKIY


YAMAHA

Źródło: http://www.nora.fo/en/index.php?pid=220



Stan ochrony krajobrazów Svalbardu

. 3 parki narodowe

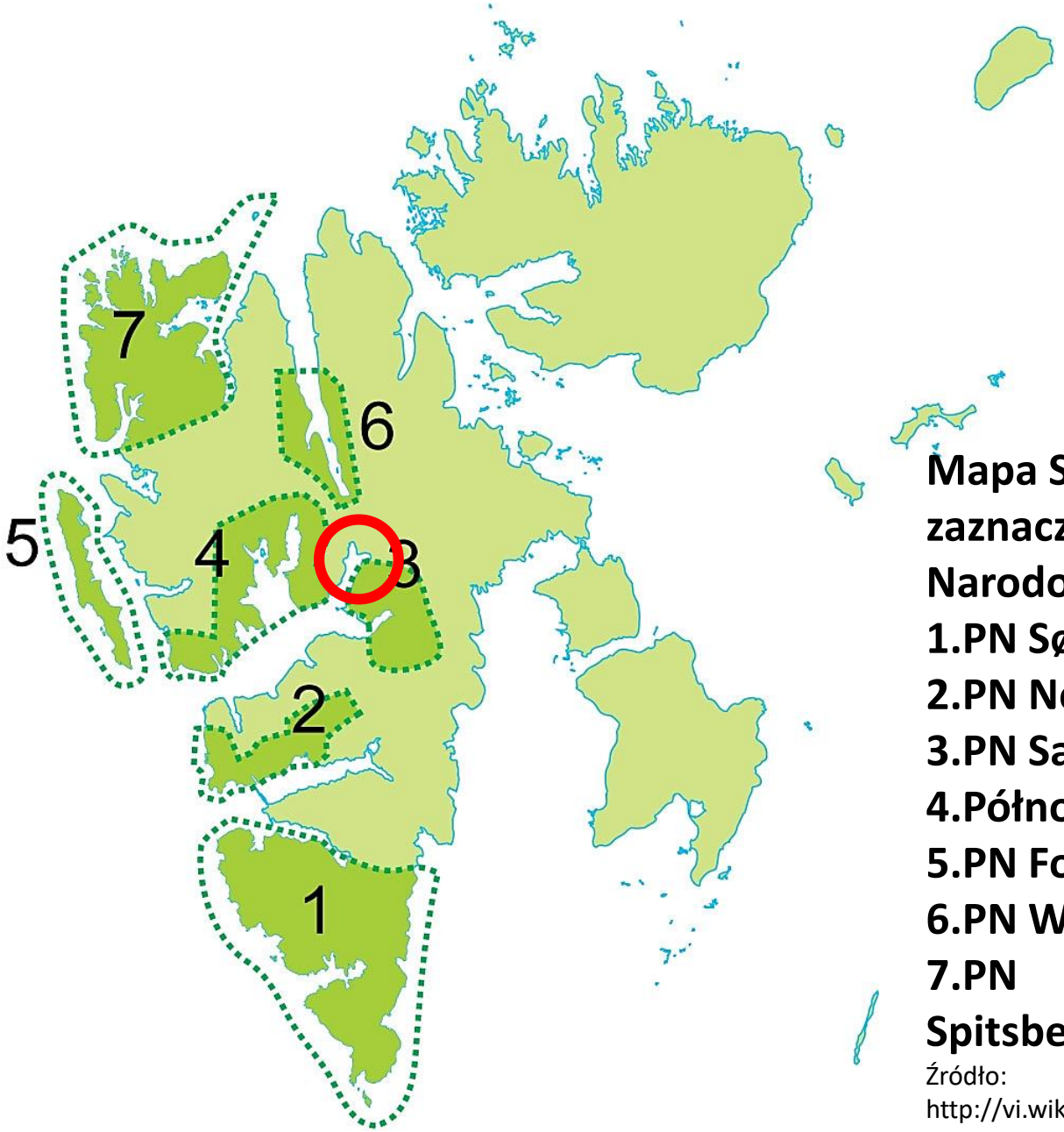
. 2 rezerwaty przyrody

. 15 ptasich ostoi
z zakazem wejścia 15.05.-15.09.;
największe kolonie ornitofauny na północnym Atlantyku

60% powierzchni archipelagu
80% terenów chronionych Norwegii

Odpowiedzialność za stan ochrony przyrody i zabytków kultury materialnej archipelagu - Gubernator Królestwa Norwegii (Environmental Section - Environmental and cultural heritage officers), wg prawa ustanowionego przez norweski Parlament

1925 r. – ochrona renifera, wówczas poważnie zagrożonego wymarciem
1929 r. – ochrona wieloryba grenlandzkiego, prawie całkowicie wytępionego
1952 r. – zakaz polowań na morsy, prawie całkowicie wytępione
1955 r. – zakaz polowań na bernikle białolice
1973 r. – ustanowienie na obszarze Svalbardu 3 parków narodowych, 2 rezerwatów przyrody i 15 ptasich sanktuariów
1974 r. – zakaz polowań na białe niedźwiedzie



Mapa Svalbardu z zaznaczonymi Parkami Narodowymi:

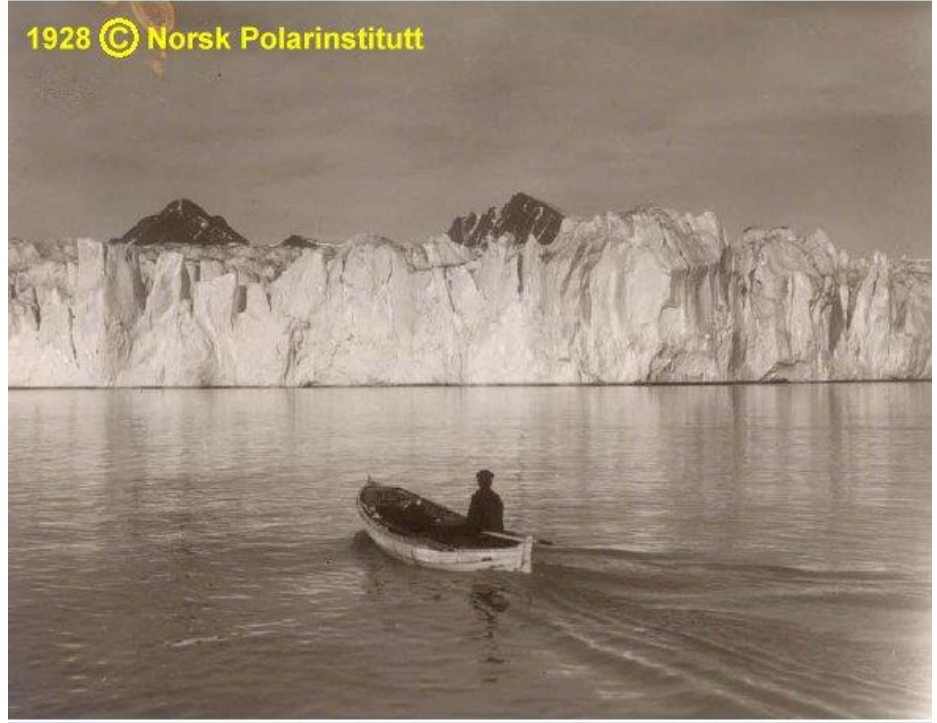
1.PN Sør-Spitsbergen,
2.PN Nordenskiöld Land,
3.PN Sassen – Bünsow Land,
4.Północny PN Isfjorden,
5.PN Forlandet,
6.PN Wijdefjorden,
7.PN Północno–Zachodniego Spitsbergenu.

Źródło:
http://vi.wikipedia.org/wiki/V%C6%B0%E1%BB%9Dn_ %91c_gia_S%C3%B8rSpitsbergen


NORDAUSTLANDET
AUSTFONNA
SPITS
BERGEN
BARENTSØYA
EDGEØYA
STORFJORDEN
STORFJORDBANKEN
FORLAND
Svenskøya
Hopen

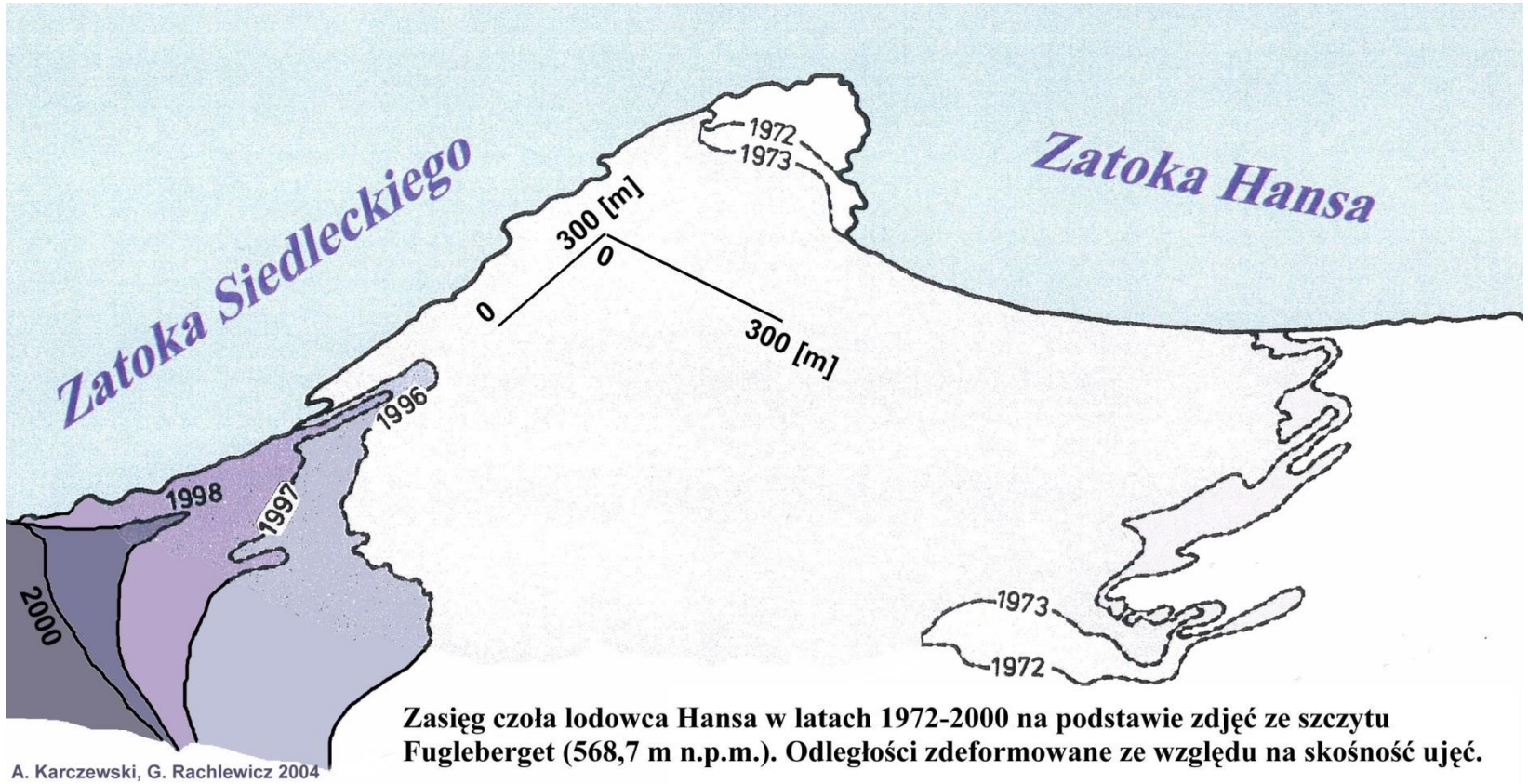
TOPNIENIE LODOWCÓW JEST „IKONĄ” GLOBALNYCH ZMIAN KLIMATYCZNYCH

[Roger Braithwaite]

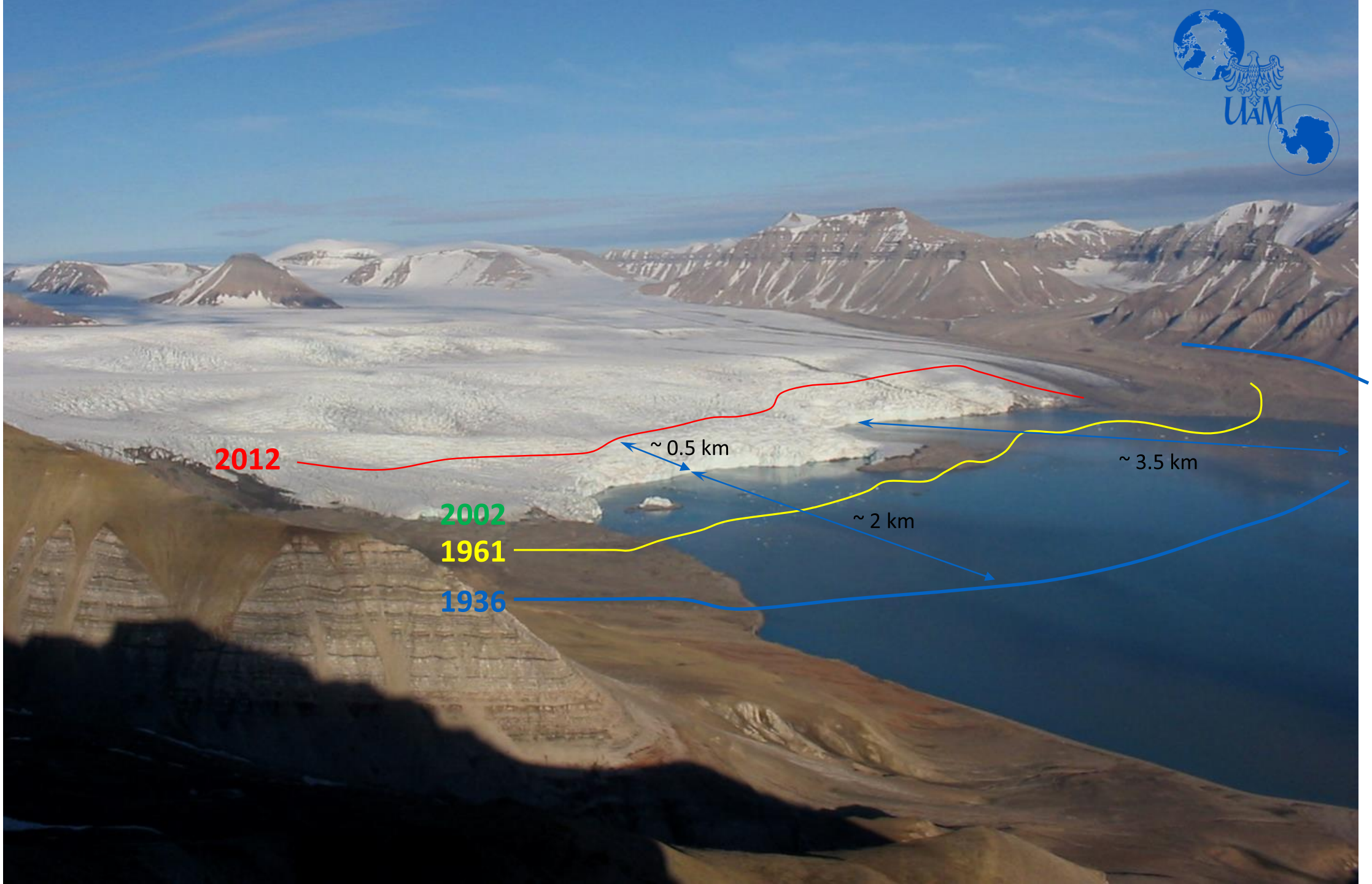

1928 © Norsk Polarinstitutt

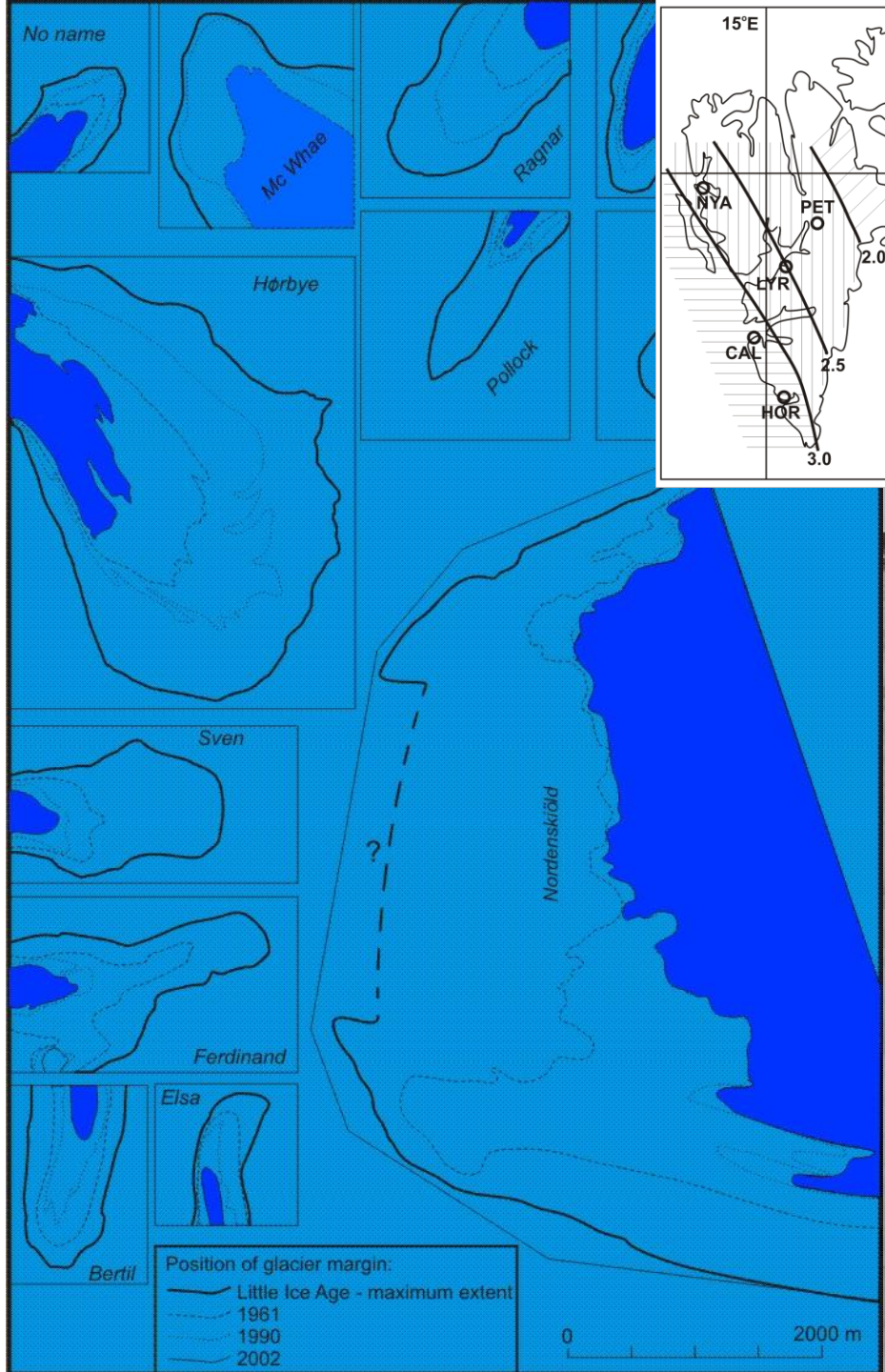

2002 © Greenpeace

Lodowiec Hansa (Spitsbergen) – 1957 i 2003

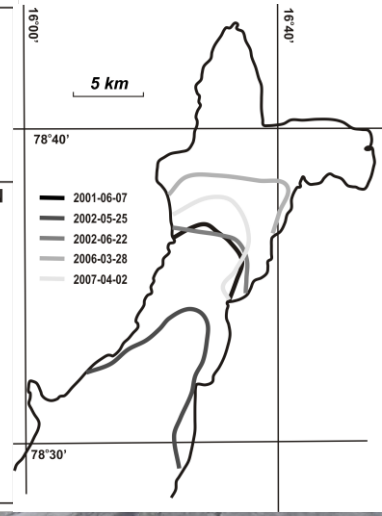


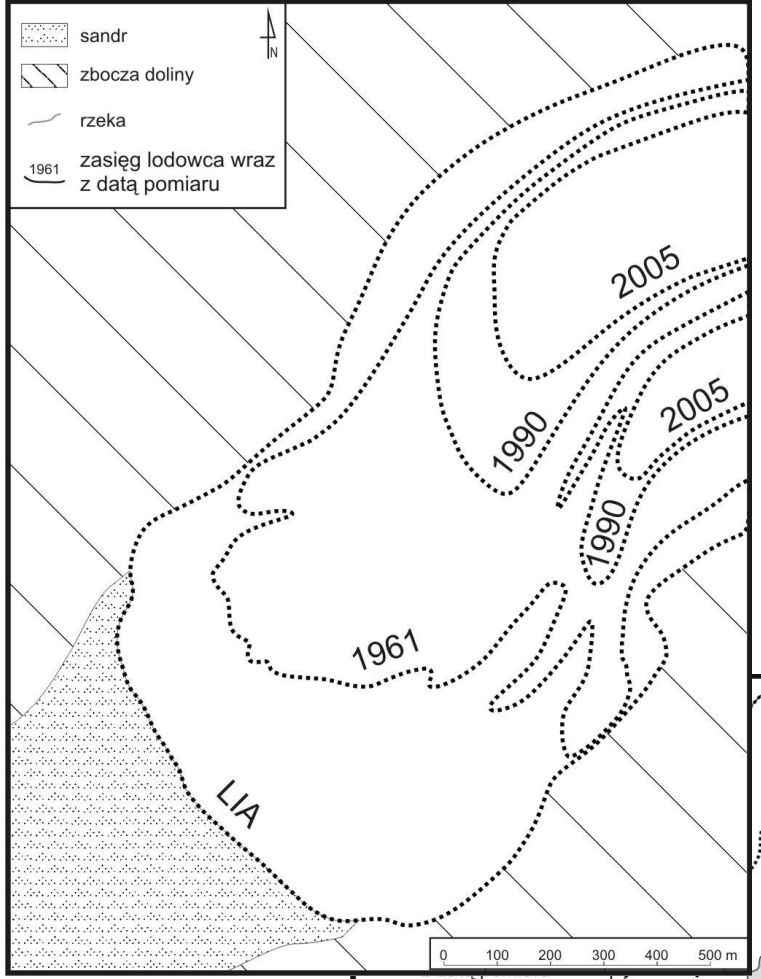
Zasięg czoła lodowca Hansa w latach 1972-2000 na podstawie zdjęć ze szczytu Fugleberget (568,7 m n.p.m.). Odległości zdeformowane ze względu na skośność ujęć.


2012
2002
1961
1936
~ 0.5 km
~ 2 km
~ 3.5 km

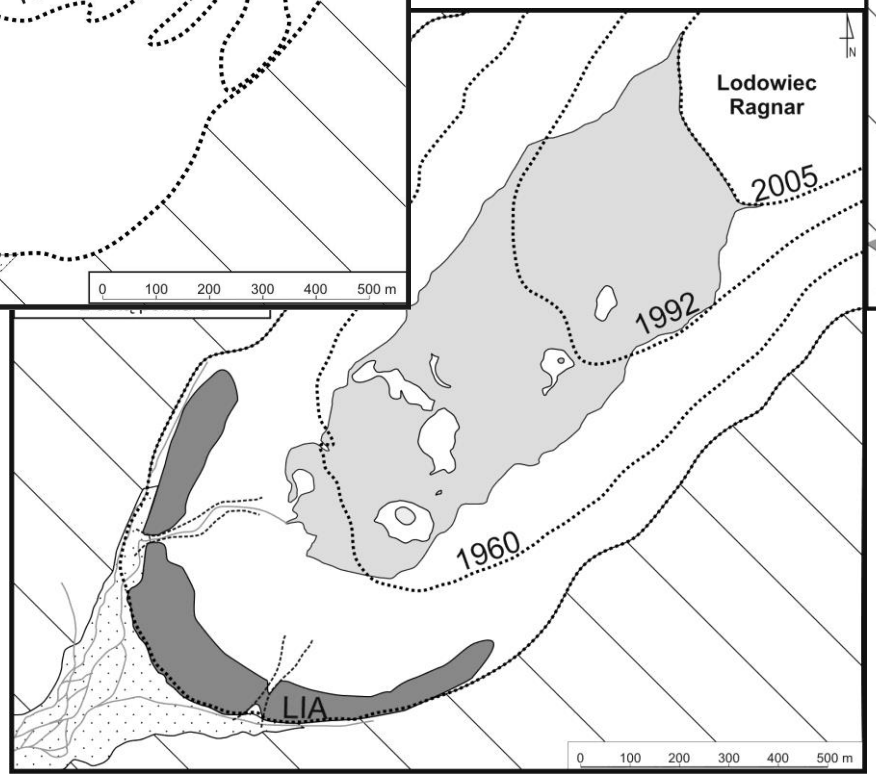

No name
Mc Whae
Ragnar
Hørbye
Pollock
Sven
Ferdinand
Elsa
Bertil
Nordenskiöld
?
Position of glacier margin:
Little Ice Age - maximum extent
1961
1990
2002
0
2000 m

15°E
79°N
NYA
PET
LYR
CAL
HOR
2.0
2.5
3.0
0
50
100 [km]


16°00'
16°40'
5 km
78°40'
78°30'
2001-06-07
2002-05-25
2002-06-22
2006-03-28
2007-04-02

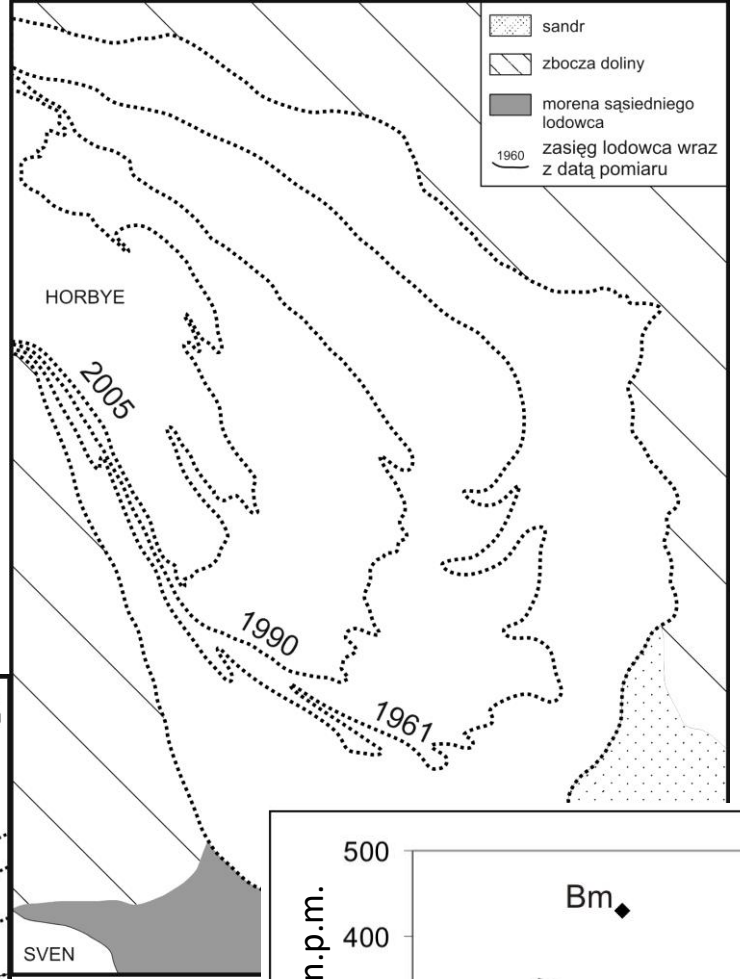


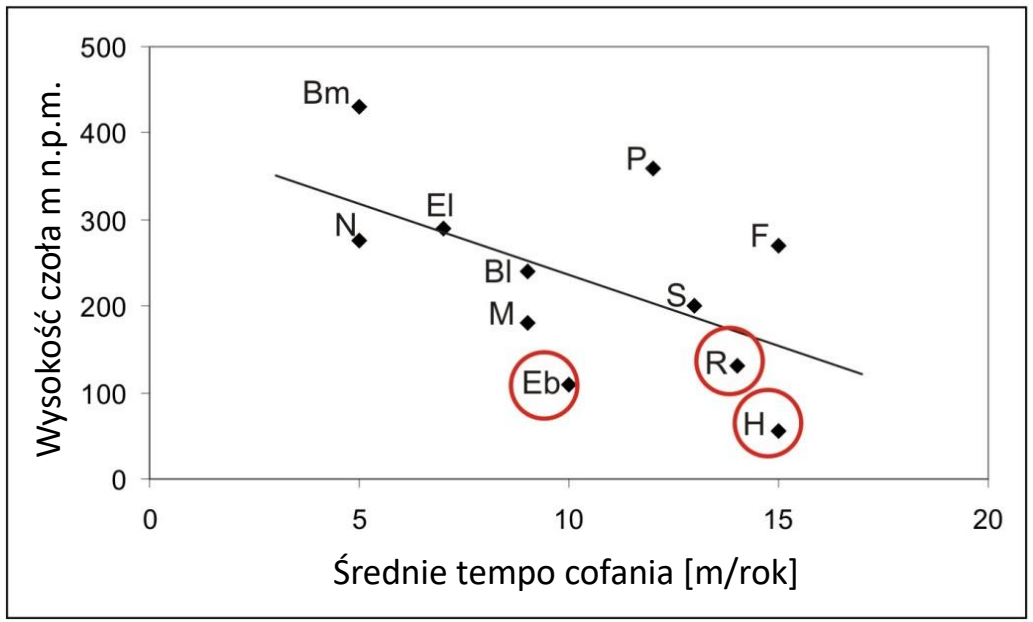
EBBABREEN



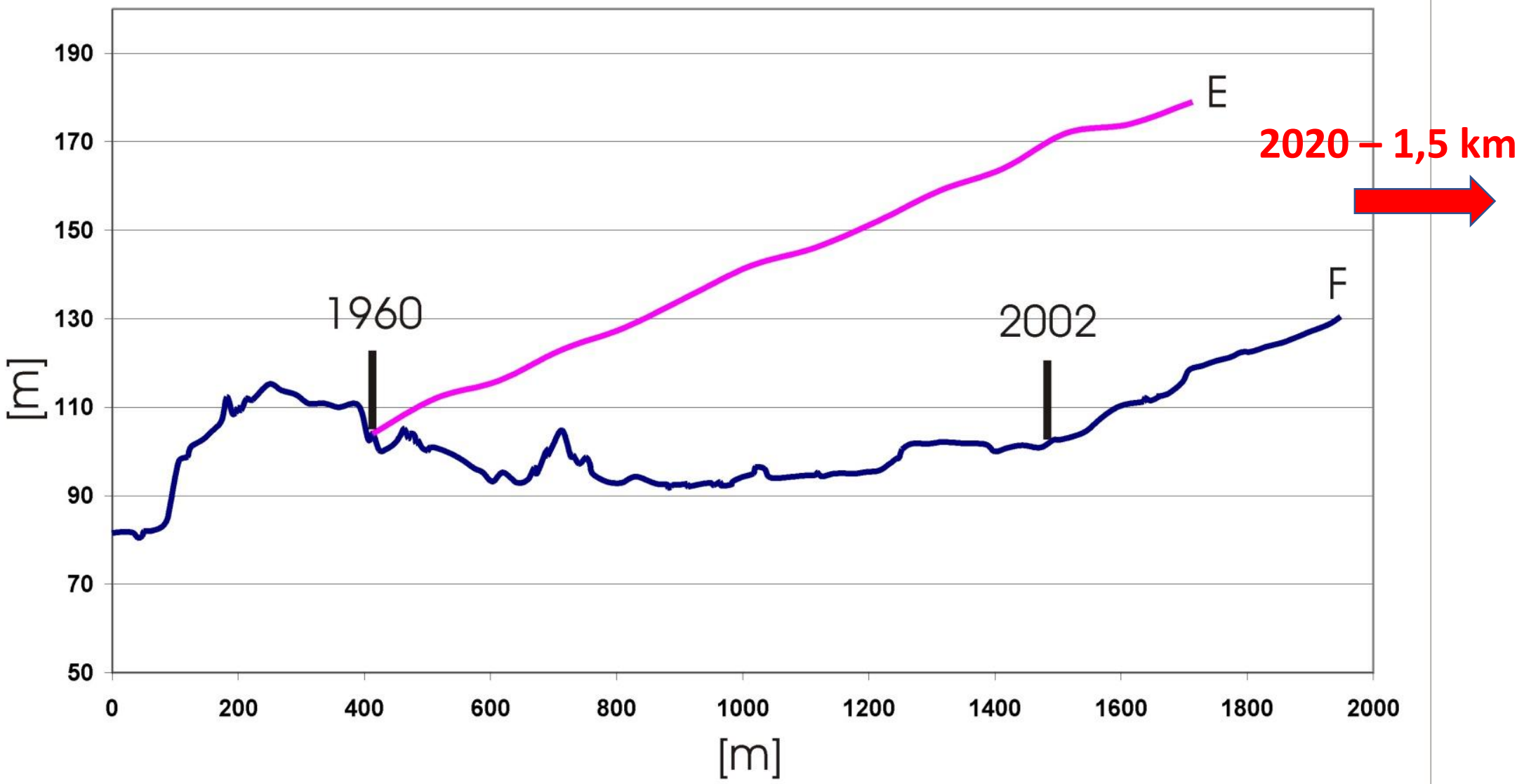
RAGNARBREEN

HORBYEBREEN

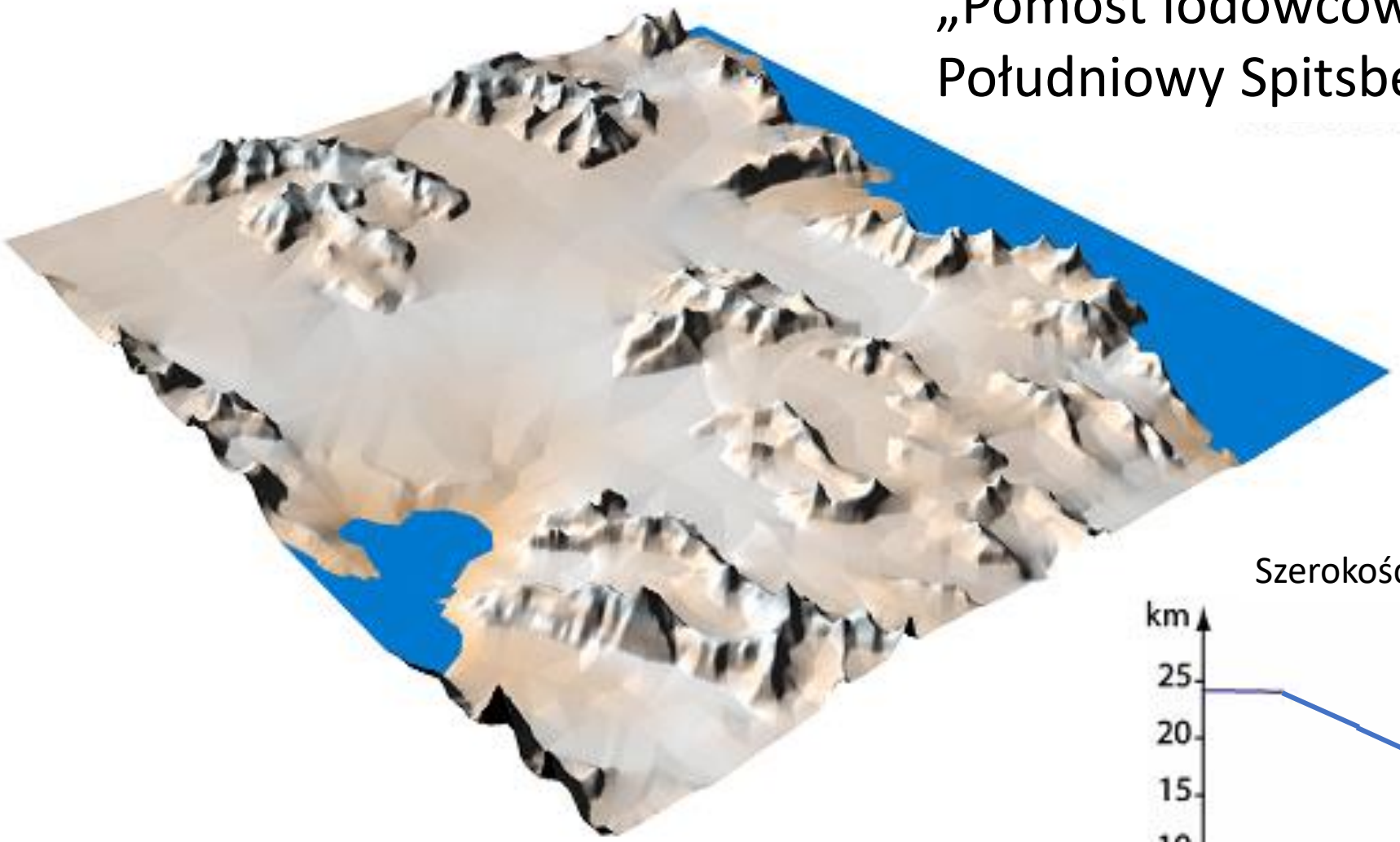




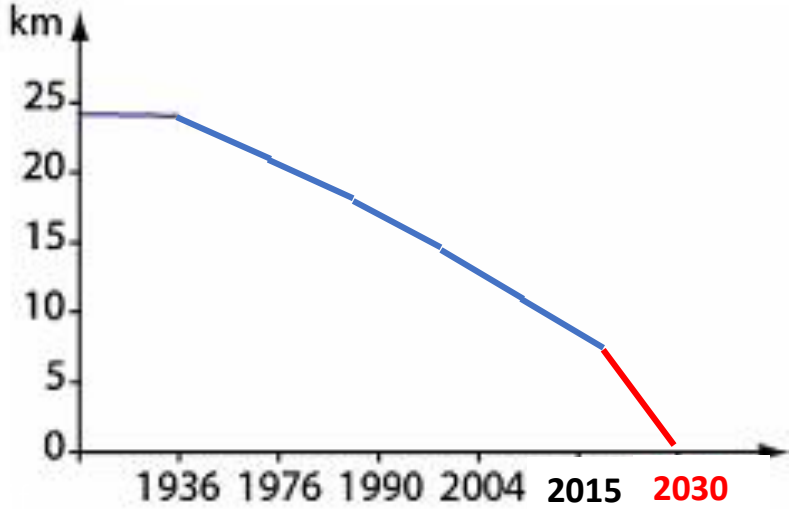
Horbyebreen – profil podłużny



„Pomost lodowcowy” w Hornsundzie, Południowy Spitsbergen

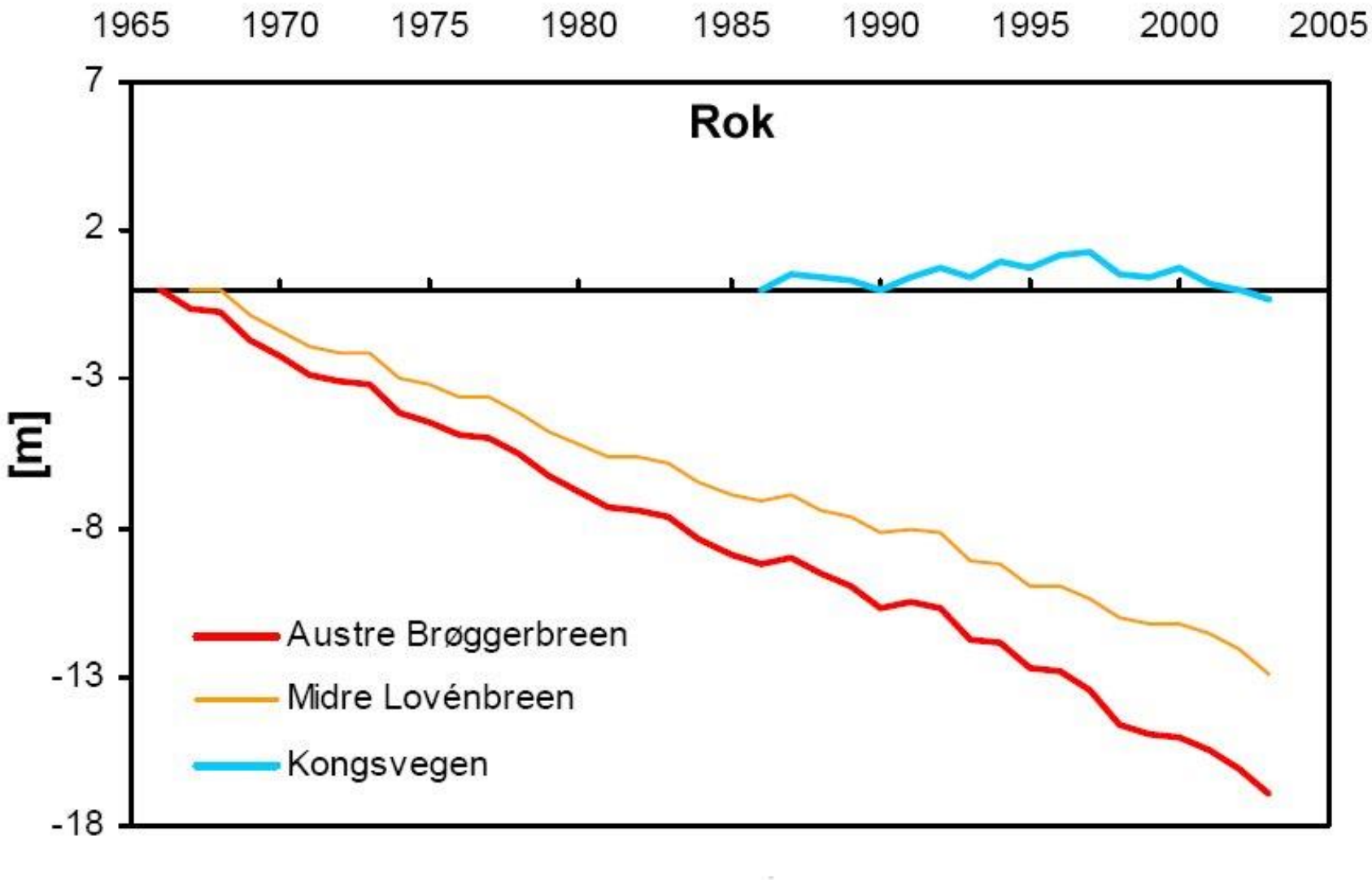


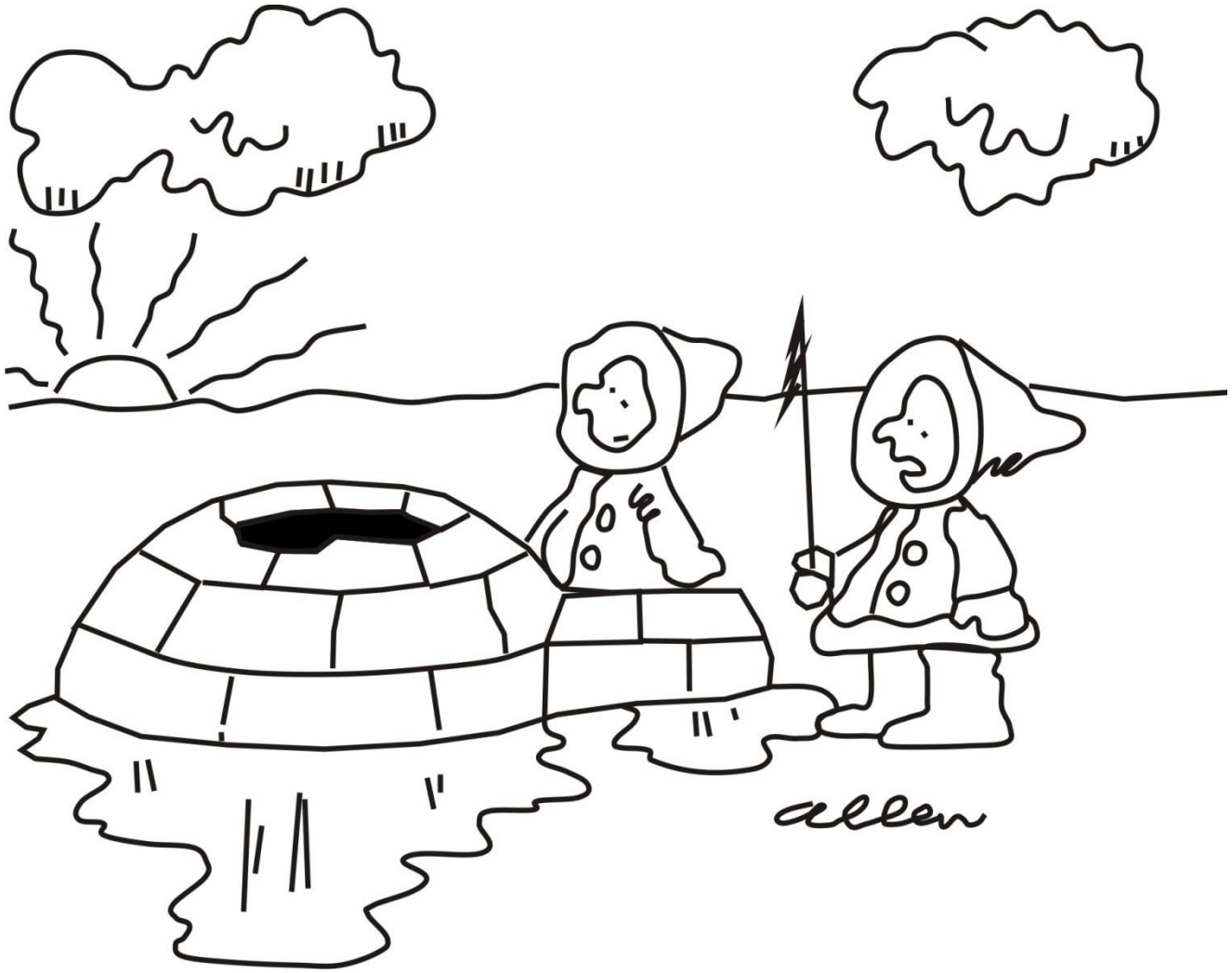
Szerokość „pomostu lodowcowego”



INSARAL ©

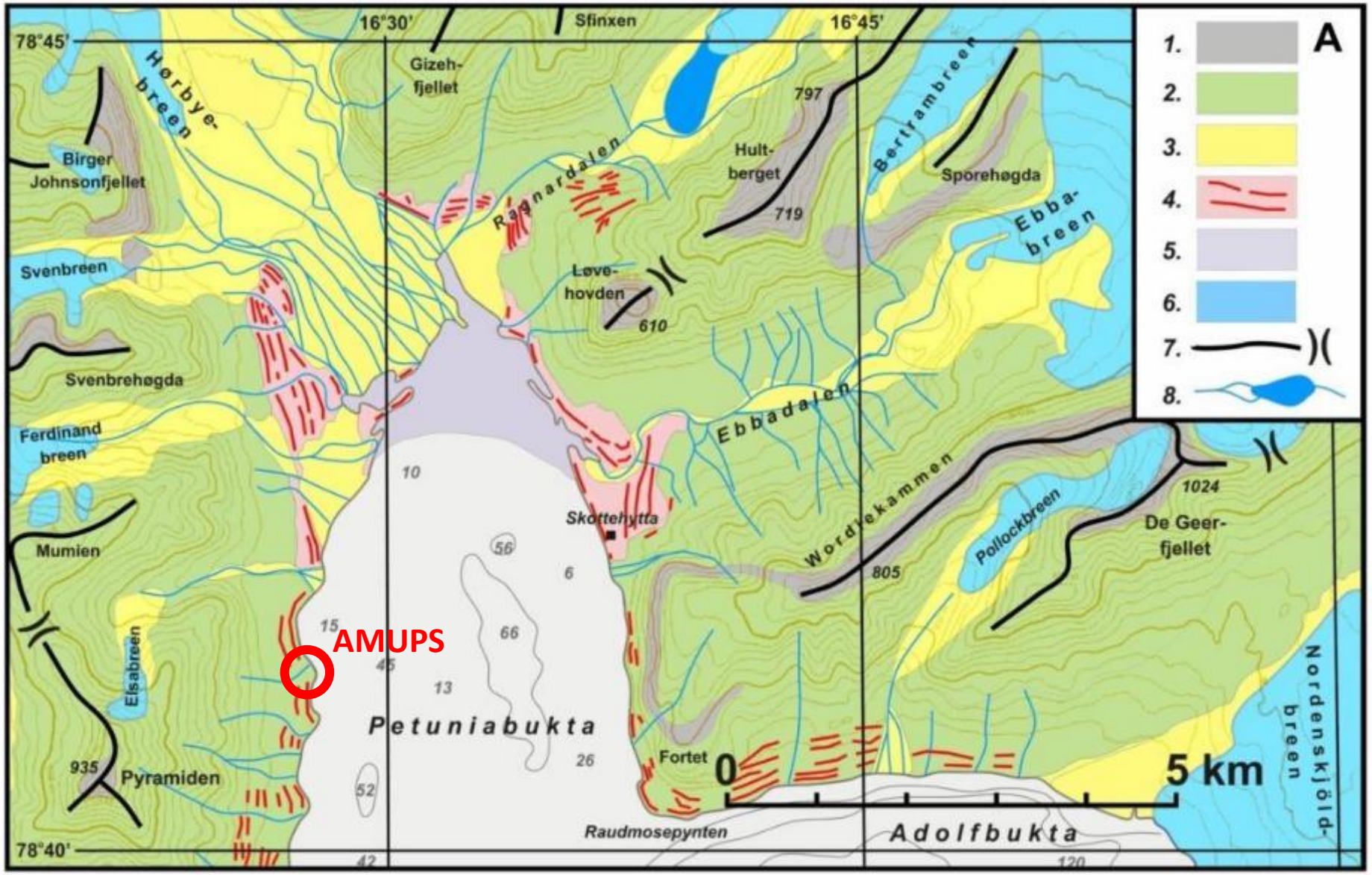
Skumulowany bilans masy





Podejrzewałem zmiany klimatu, ale okazało się,
że zapomniałem wyłączyć grzejnika

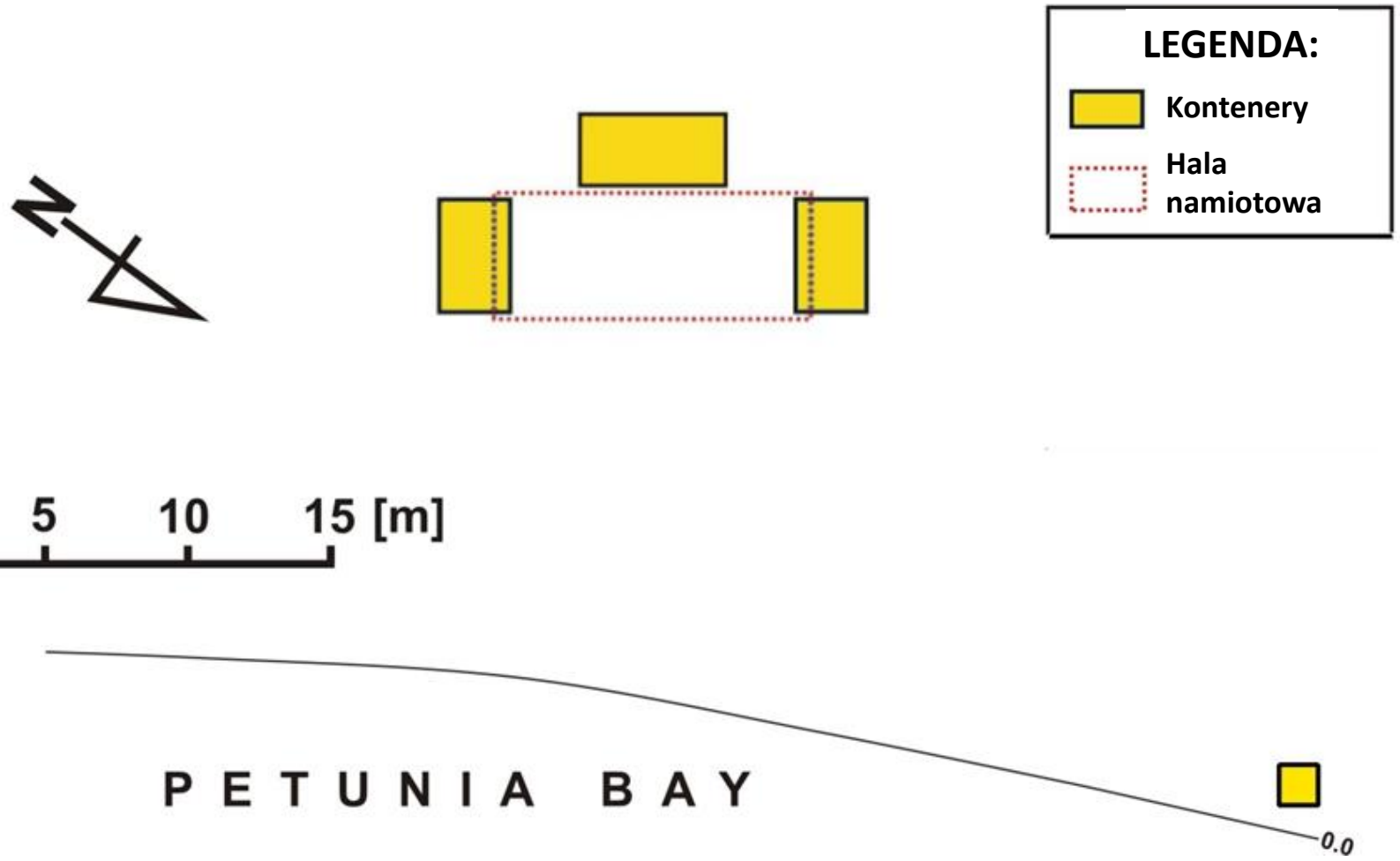

Stacja Polarna
UMK Toruń
78,673609°N
78,705327°N
2,143 km
Stacja Polarna
UAM Poznań
Polska Stacja
Polarna „Hornsund”

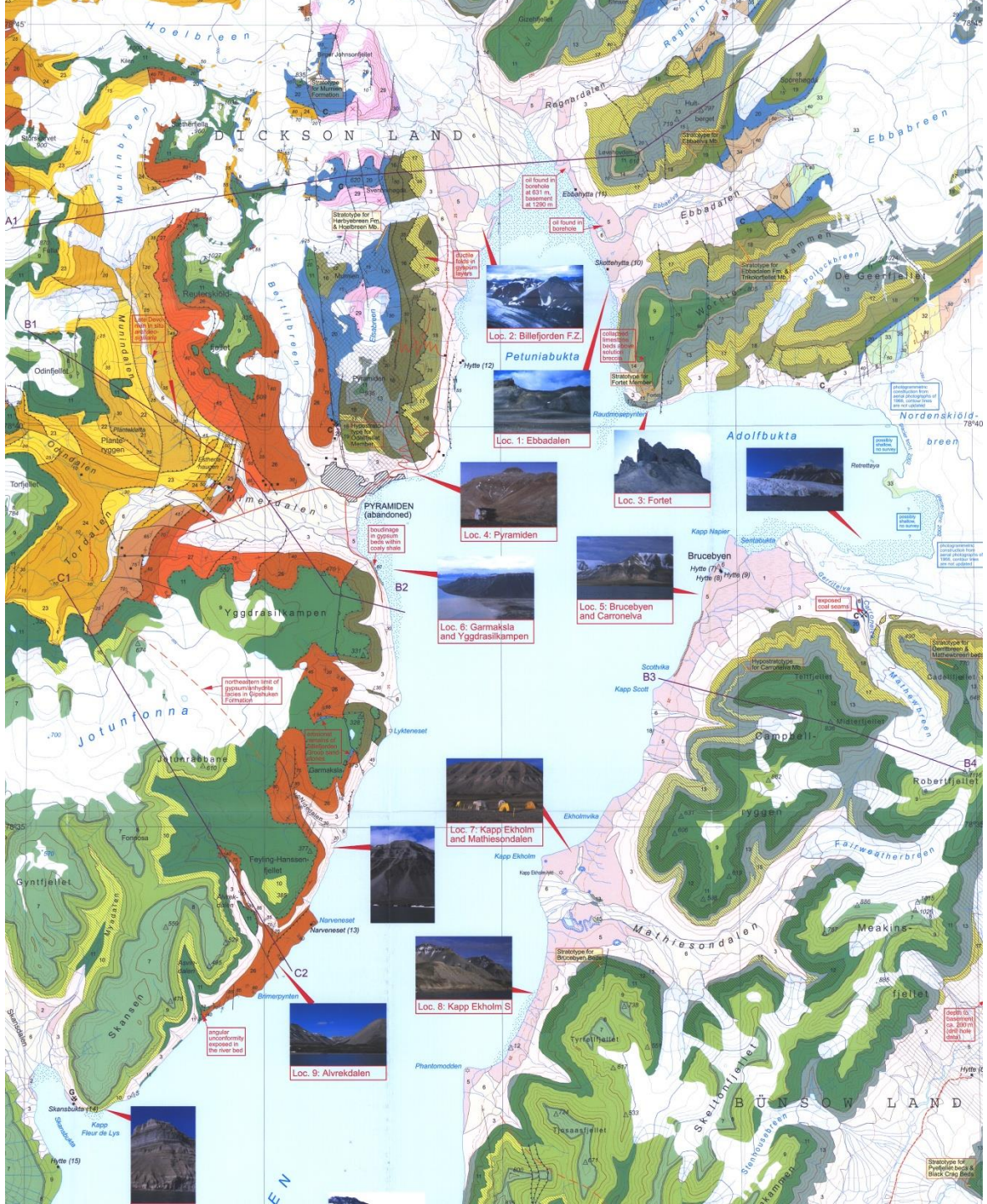

78°45'
16°30'
Sfinxen
16°45'
Hørbye-breen
Gizeh-fjellet
797
Bertrambreen
Birger Johnsonfjellet
Ragnardalen
Hult-berget
Sporehøgda
719
Ebba-breen
Svenbreen
Løve-hovden
610
Svenbrehøgda
Ferdinand breen
Ebbadalen
10
Skottehytta
Wordiekammen
1024
Pollockbreen
De Geer-fjellet
Mumien
56
6
805
15
AMUPS
66
45
13
Elsabreen
Petuniabukta
26
Fortet
935
Pyramiden
52
0
5 km
Nordenskjöld-breen
Raudmosepynten
Adolfbukta
78°40'
42
120
A
1.
2.
3.
4.
5.
6.
7.
8.


SKOTTEHYTTA
ETC


SPITSBERGEN
78°N 16°E
2022

Stacja Polarna
PETUNIABUKTA
Uniwersytetu im. Adama Mickiewicza w Poznaniu
Spitsbergen - Svalbard





Geological map of Billefjorden, Central Spitsbergen, Svalbard

with geological excursion guide

Winfried K. Dallmann, Karsten Piepjohn, Dierk Blomeier

Temakart No. 36, Norsk Polarinstitutt 2004

LEGEND

Stratigraphy and lithology

Quaternary sediments
This map gives priority to bedrock geology. Quaternary cover sediments are only shown where they constitute distinct and significant bodies, or where they cover the bedrock over large, continuous areas.

1 Extensive swamp area
2 Moraine (Holocene)
3 Slope deposits (talus and undifferentiated material, Holocene)
4 Eolian deposits (Holocene)
5 Marine shore deposits (Holocene)
6 Fluvial and glaci-fluvial deposits (Pleistocene and Holocene)

Tempelfjorden Group (late Early and late Permian)
The Tempelfjorden Group consists of marine shelf sediments in various depositional settings, which were deposited under abundant production of siliceous material from sponge spicules. It comprises three members. Only the lowermost, the Vøringen Member, is laterally continuous across large areas.

7 Kapp Starostin Formation (late Artinskian to Kazanian) – chert, shale, glauconitic sandstone, siliceous limestone
8 Vøringen Member – bioclastic limestone

Gipsdalen Group (late Early Carboniferous to Early Permian)
The Gipsdalen Group comprises all depositional units from narrow trough to open marine shelf sediments across Svalbard.

Dickson Land Subgroup (late Moscovian to early Artinskian)
The Dickson Land Subgroup consitutes the later stage of the Gipsdalen Group, with mainly carbonate shelf deposits covering both former trough and high areas.

9 Gipshuken Formation (late Sakmarian to early Artinskian) – gypsum/anhydrite, dolomite breccia, dolomite and limestone
10 Vengeberget member (gypsum/anhydrite-dominated section, confined to the south-western part of the map area)
Northeastern limit of gypsum/anhydrite facies in Gipshuken Formation
11 Wordiekammen Formation (late Moscovian to early Sakmarian) – limestone and dolomite, basal calcareous sandstone west of Billefjorden (part of Kapitol Member). A basal dark mudstone (Black Crag) occurs east of Petuniabukta and Billefjorden and Gipsdalen. The subdivision of the formation into Cadellfjellet Member (lower part east of Billefjorden, see below) and Tyrrellfjellet Member (upper part, limestone, dolomite, dark fusulina limestones (Brucebyen Beds) at the base) is indicated only where distinct.
12 Cadellfjellet Member (occurs only east of Billefjorden, only indicated where distinct) – limestone and dolomite, phylloid algal and/or palaeoaplysina build-ups. Basal dark mudstone (Black Crag).

Campbellryggen Subgroup (Serpukhovian to Early Kasimovian)
The Campbellryggen Subgroup records the early stage of the Gipsdalen Group's development and comprises the sediments deposited in the Billefjorden Trough. Except for the Hultberget Formation, the rocks occur only east of the Billefjorden Fault Zone (BFZ). The individual formations and members are thickest ca. 3-5 km east of the syn-sedimentarily active BFZ and attenuate eastward.

13 Minkinfjellet Formation (Moscovian and early Kasimovian) – north of Petuniabukta distinct threefold subdivision: Carronelva member – sandstone, dolomite, limestone, gypsum/anhydrite, eastward attenuating; Terrierfjellet member – dolomite and limestone, subordinate gypsum; Fortet member (see below). The boundary between the two lower members is mostly hidden by scree. South of Petuniabukta the subdivision is more irregular, although northward attenuating gypsum/anhydrite layers form distinct elements.
14 Fortet member (only indicated north of Petuniabukta) – dolomite solution breccia
15 Gypsum/anhydrite-dominated sections (only indicated south of Petuniabukta)

Ebbadalen Formation (Bashkirian) - the formation is subdivided into the conglomeratic Odelfjellet Member (close to BFZ in the west), the Ebbaelva (lower, east) and Trikolorfjellet Member (upper, east). The two latter interfinger with the first; the boundary on the map is therefore generalised.
16 Odelfjellet Member (dominating rocks west of Billefjorden) – polymict, multi-coloured conglomerate and sandstone
17 Trikolorfjellet Member – gypsum/anhydrite, dark limestone
18 Ebbaelva Member – multicoloured sandstone, shale, limestone, dolomite, gypsum/anhydrite
19 Hultberget Formation (Serpukhovian) – red sandstone, shale and conglomerate. The formation also occurs on the Nordfjorden High west of the BFZ, although thinner.

Billefjorden Group (Early Carboniferous: Tournaisian and Visèan)
The Billefjorden Group reflects fluvial and nearshore clastic sedimentation and coal formation in tectonic depressions subsequent to the Svalbardian tectonic event. It is thought to have been deposited in the entire map area.

20 Hørbyebreen and Mumien formations (undifferentiated) – sandstone, conglomerate, shale and coal

Andrée Land Group (Devonian)
The Andrée Land Group is the upper of three lithostratigraphic groups of the Old Red Sandstone of Svalbard, and thus represents a post-orogenic molasse. It is only preserved west of the Billefjorden Fault Zone. Conglomerates in the upper formations may indicate initial phases of the Svalbardian tectonic event, which folded and thrusted parts of the Old Red Sandstone.

Mimerdalen Subgroup (Frasnian-Famennian)
The Mimerdalen Subgroup occurs only from the Mimerdalen area northward to Ålandsdalen (Fiskekløfta Formation), where the boundary with the lithologically similar – although normally older (Eifelian) Grey Hoek Formation – has not yet been determined.

21 Plantekløfta Formation – grey conglomerate, sandstone and shale
Planteryggen Formation
22 Muninelva Member – grey sandstone and conglomerate
23 Odinelva Member – multicoloured sandstone and siltstone, red conglomerate
Tordalen Formation
24 Fiskekløfta Member – greenish sandstone and siltstone
25 Estheriahaugen Member – shale and siltstone, green sandstone interbeds
Wood Bay Formation (Lochkovian to Emsian)
26 Dicksonfjorden Member – red or greenish sandstone and shale
27 Austfjorden Member – yellow and greenish, carbonate-cemented sandstone and shale, subordinate conglomerate
28 Mimerbukta sandstone – strongly deformed rocks of the Wood Bay Formation and Mimerdalen Subgroup

Metamorphic basement rocks (Palaeo- and Mesoproterozoic)
The metamorphic basement units are listed in tectonostratigraphic order, which does not coincide with their age. It is believed that at least the Bangenhuk and Eskolabreen units have Palaeoproterozoic protoliths.

29 Bangenhuk unit – granitic gneiss, locally migmatitic, with intercalated amphibolite
30 Rittervatnet unit – mica schist, quartzite, amphibolite and marble
31 Polhem unit, upper part – quartzite and amphibolite
32 Polhem unit, lower part – mica schist and amphibolite
33 Smutsbreen unit – garnet-mica schist, calc-pelitic schist and marble
34 Eskolabreen unit – biotite (amphibole) gneiss, amphibolite, granitic gneiss
35 Distinct marble layers within other basement units

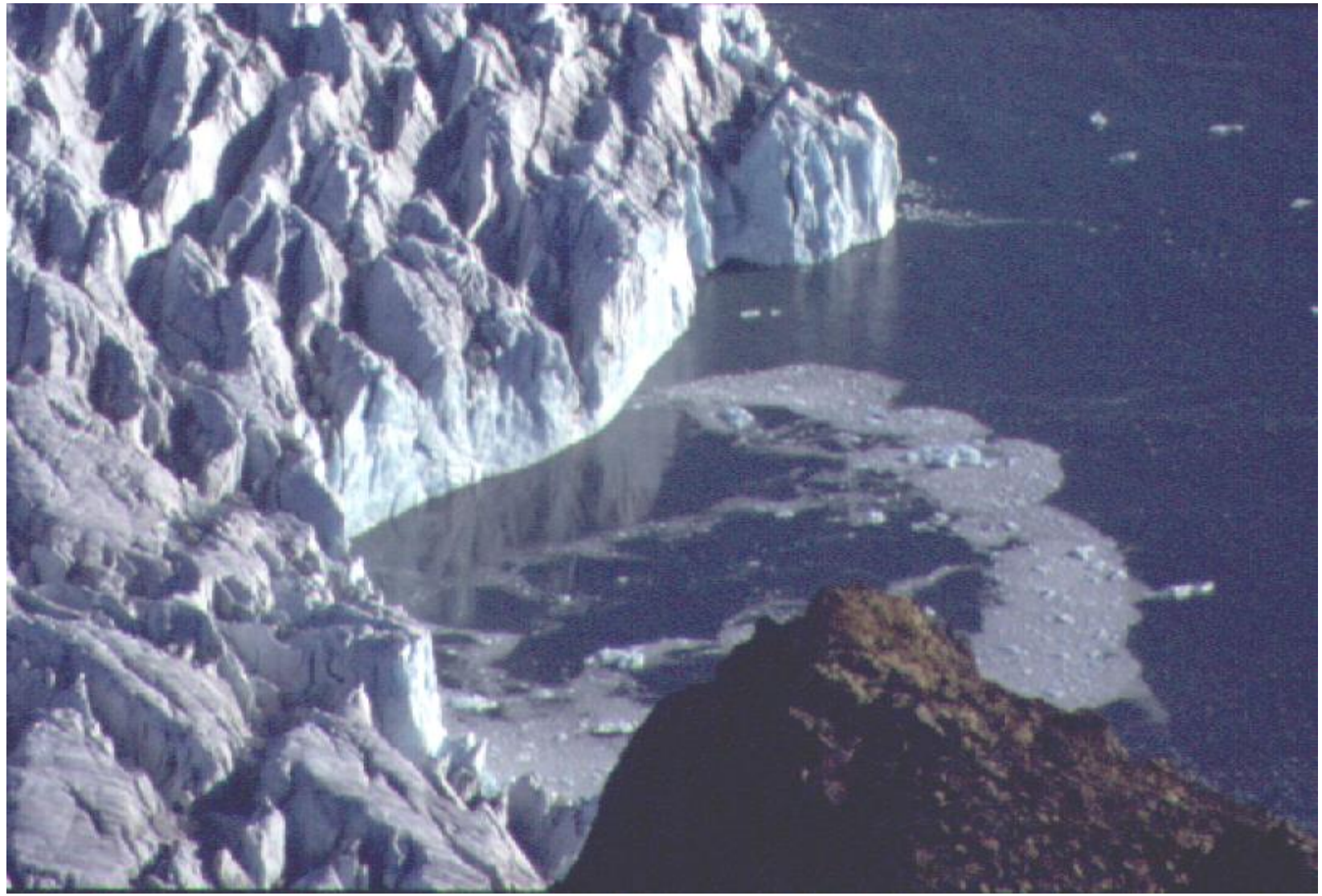
Intrusive rocks
36 Dolerite (Amer.: *Diabase*) sills and dikes (mainly Early Cretaceous). During the Early Cretaceous, the North Atlantic region was subject to tensional tectonics due to initial mid-ocean rifting of the future North Atlantic Ocean. Basaltic magmas intruded the crust and also extruded as lavas in eastern Svalbard.
37 Lamprophyre dikes (Silurian – Early Devonian). One small occurrence at Ragnarbreen
38 Gabbroic dikes (Proterozoic). A few small occurrences in the Billefjorden Basement Horst

Geological sections

C1 Position of cross section
Stratotype for ... Position of stratotype (documented in Stratigraphic Lexicon of Svalbard)

Geological structures

Rock boundary
Angular unconformity, dots towards overlying beds
Bedding orientation (strike and dip direction / horizontal / vertical / inverted), dip angle in degrees
Normal fault, barbs towards downthrow side
Reverse fault, teeth towards overthrust side
Fault with reactivated movement, symbols towards dip direction
Fault, unspecified
Boundary of landslide, teeth on landslide
Anticline, axial surface trace
Syncline, axial surface trace
Monocline, axial surface trace

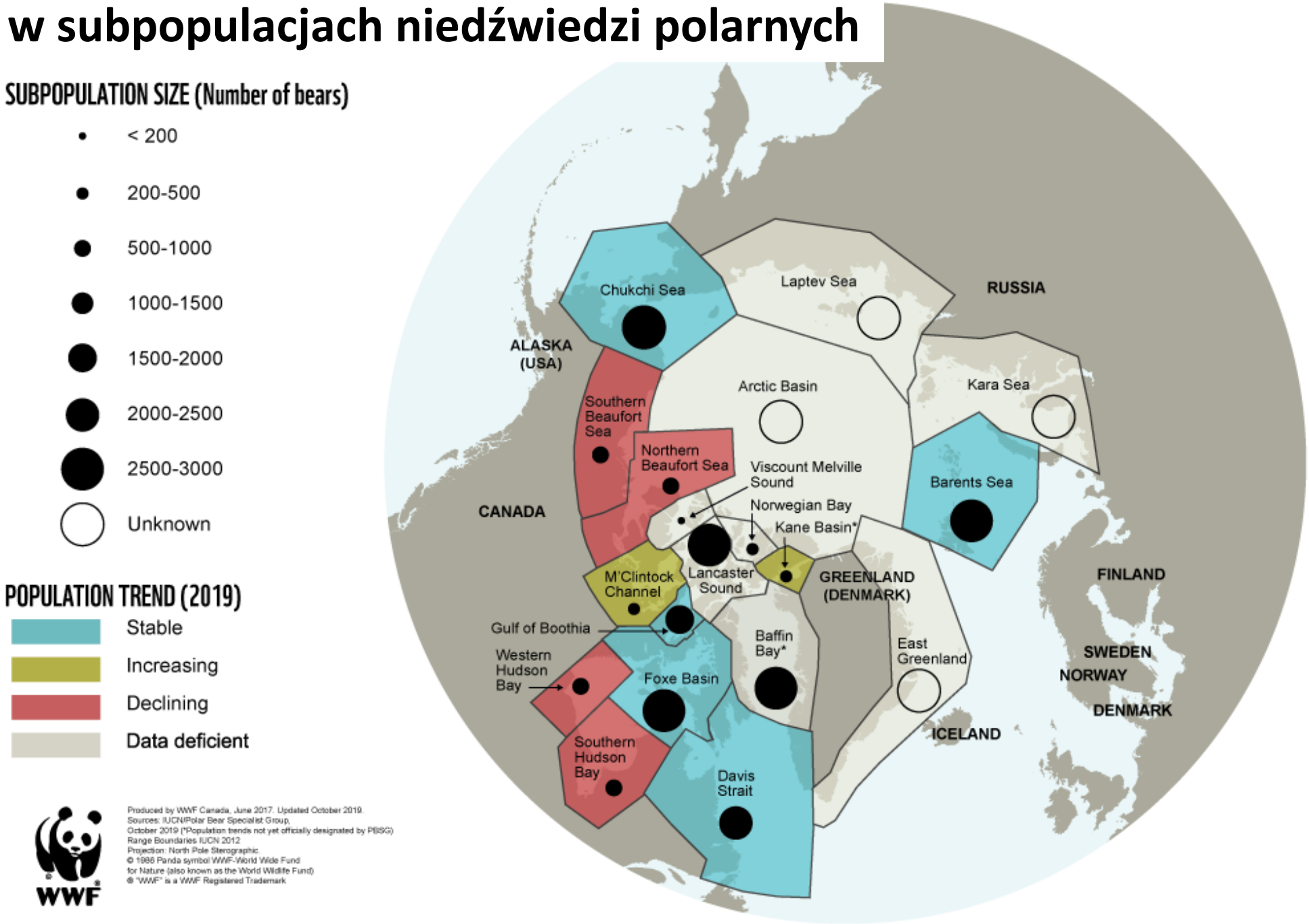


Dryas octopetala, Ebbadalen, Petuniabukta

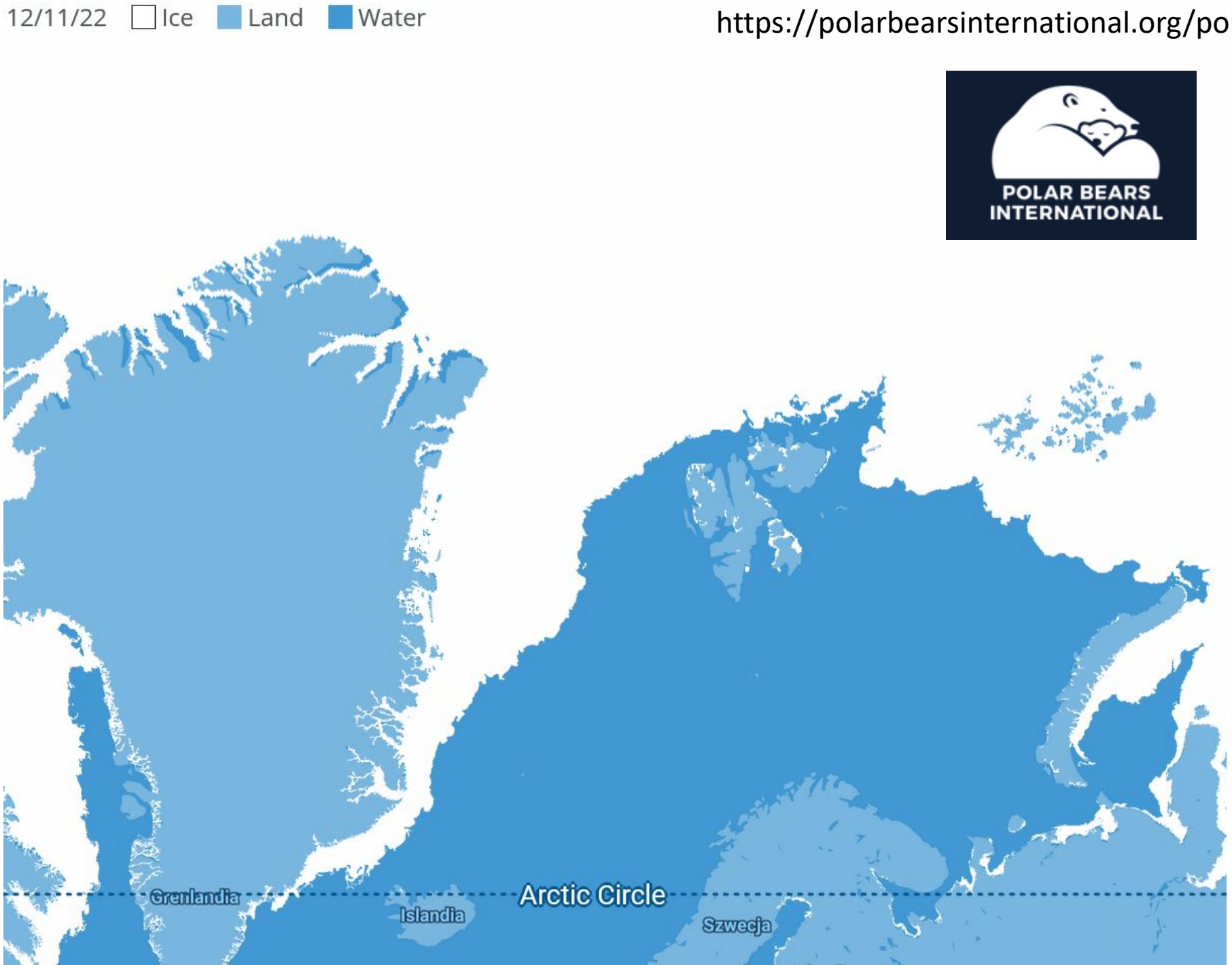

Fot. M. Zajączkowski

1,5 niedźwiedzia polarnego / 1,0 mieszkańca

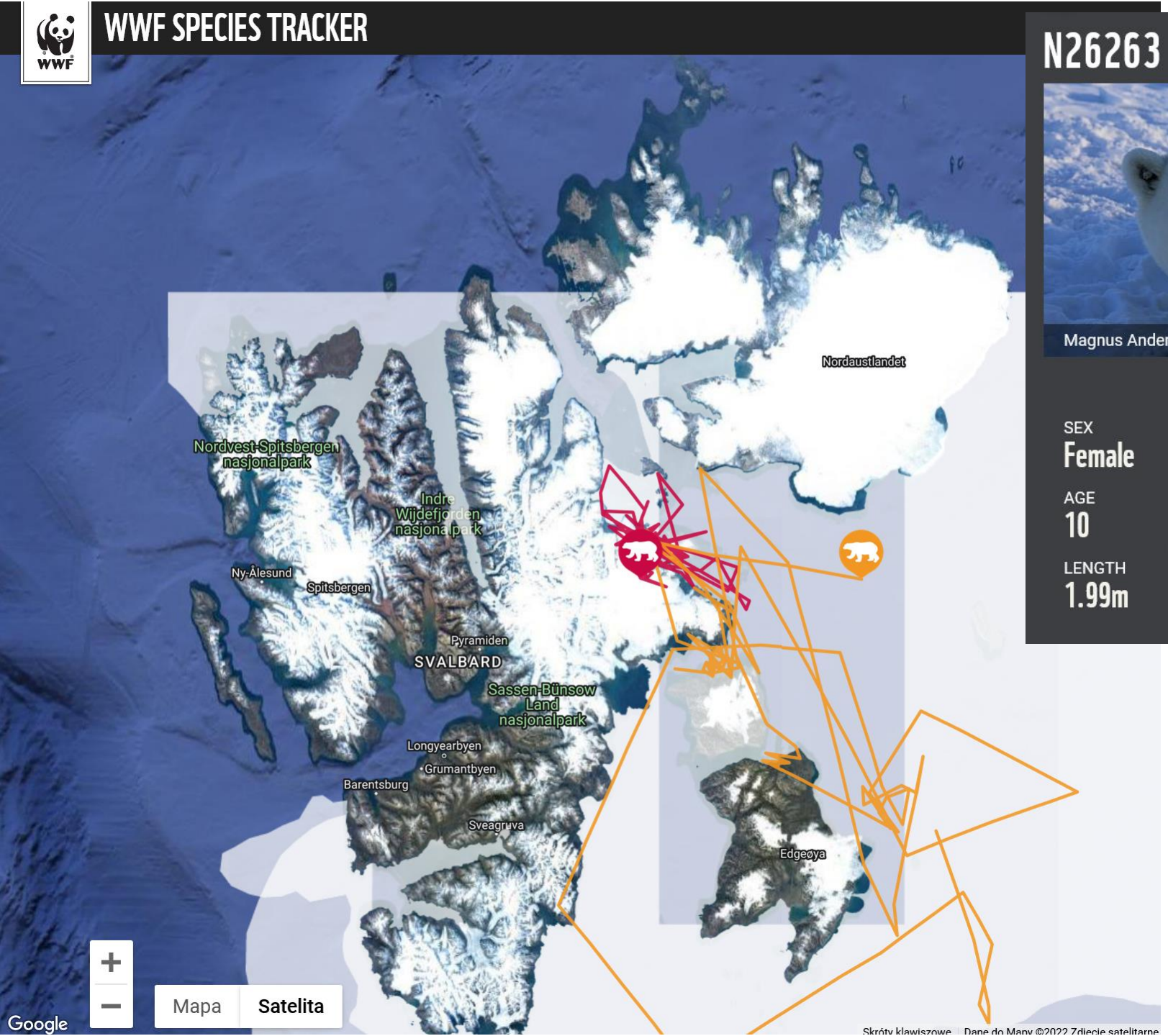
Trendy w subpopulacjach niedźwiedzi polarnych



https://polarbearsinternational.org/polar-bear-tracker



WWF SPECIES TRACKER



N26263

SEX
Female

AGE
10

LENGTH
1.99m

MOST RECENT LOCATION
2022-01-26

ESTIMATED TRAVEL
1006 km

N26358 (Lumi)

SEX
Female

AGE
11

CUBS
0

LENGTH
211 cm

WEIGHT
188 kg

MOST RECENT LOCATION
2021-03-31

ESTIMATED TRAVEL
2527 km


Michael Durham/Oregon Zoo


USGS©


WWF


svalbardi.com


phys.org

Photo: Thomas Nilsen

usatodaysports.com

Arild Lyssand / AFP - Getty Images


https://www.facebook.com/WNGiG/videos/796666078381176
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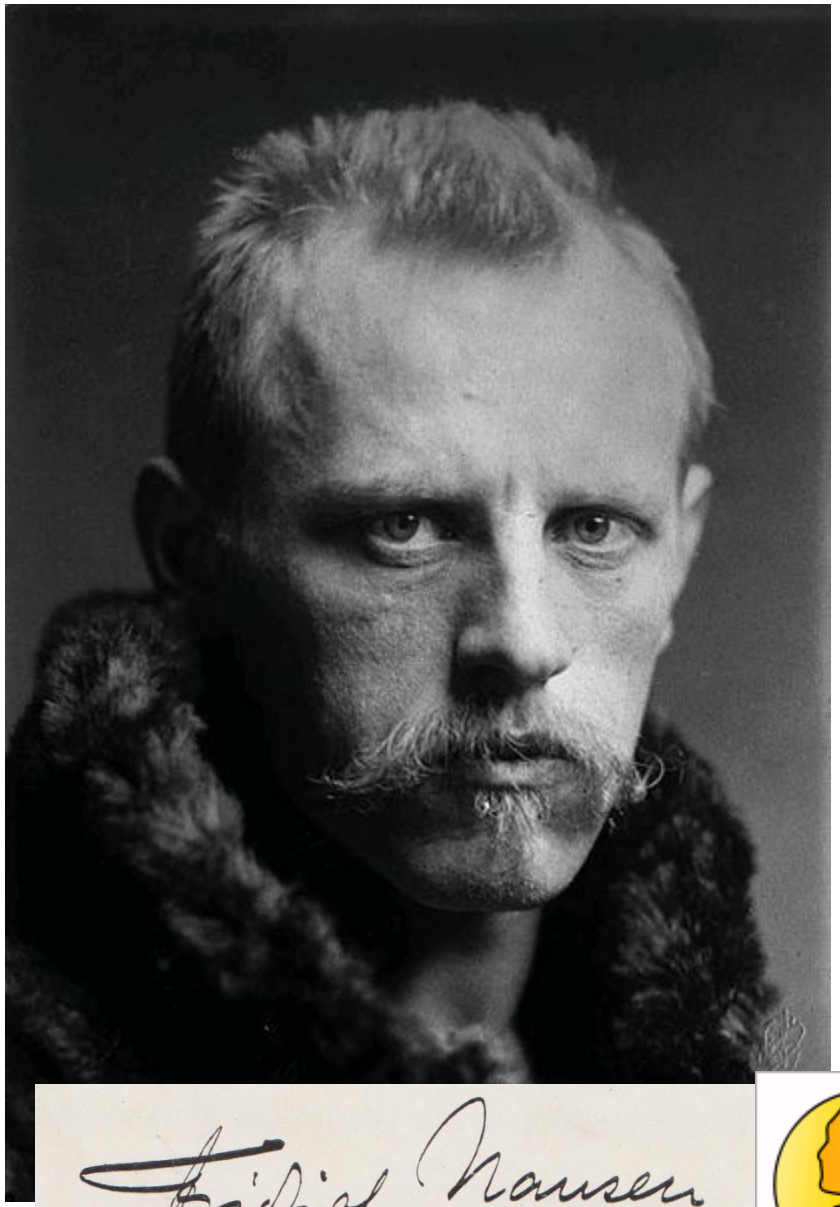
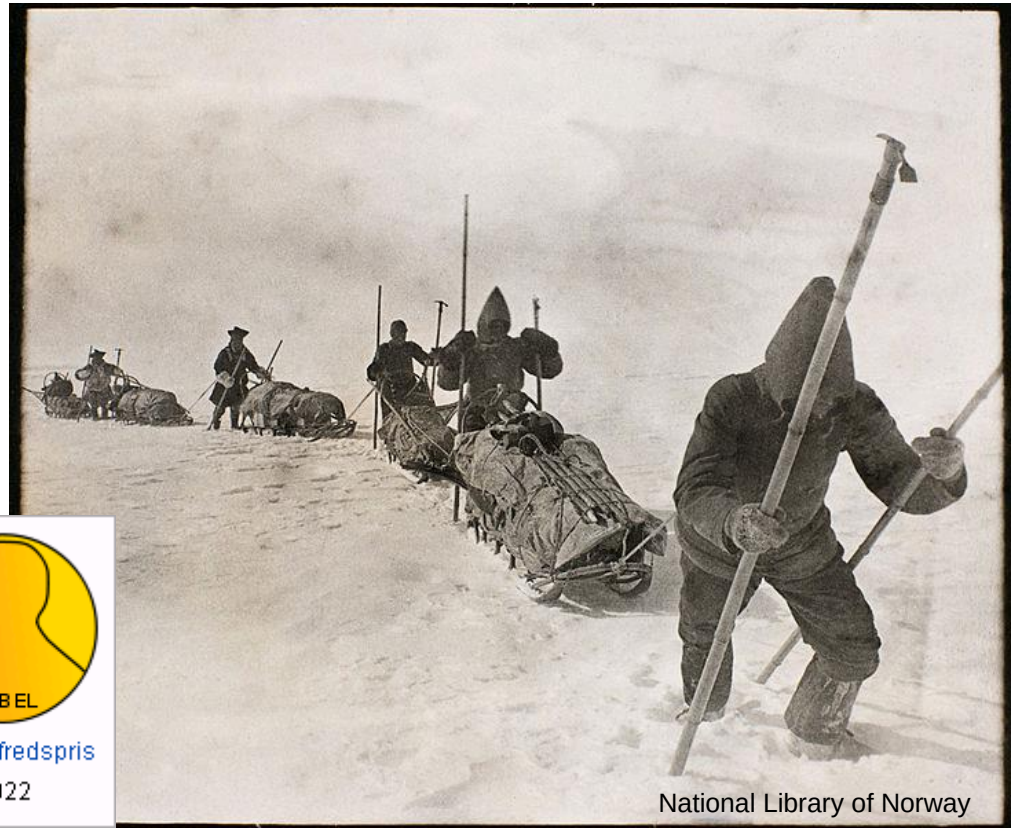


1861-1930

„Przestaję być człowiekiem,
kiedy przestaję poszukiwać…”
[Fridtjof Nansen]



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Projekt dofinansowany ze środków budżetu państwa w ramach programu
Ministra Edukacji i Nauki pod nazwą
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