Sediment dynamics and sub-recent sediment budget of the braided sandur system at Sandane, Erdalen (Nordfjord, western Norway)

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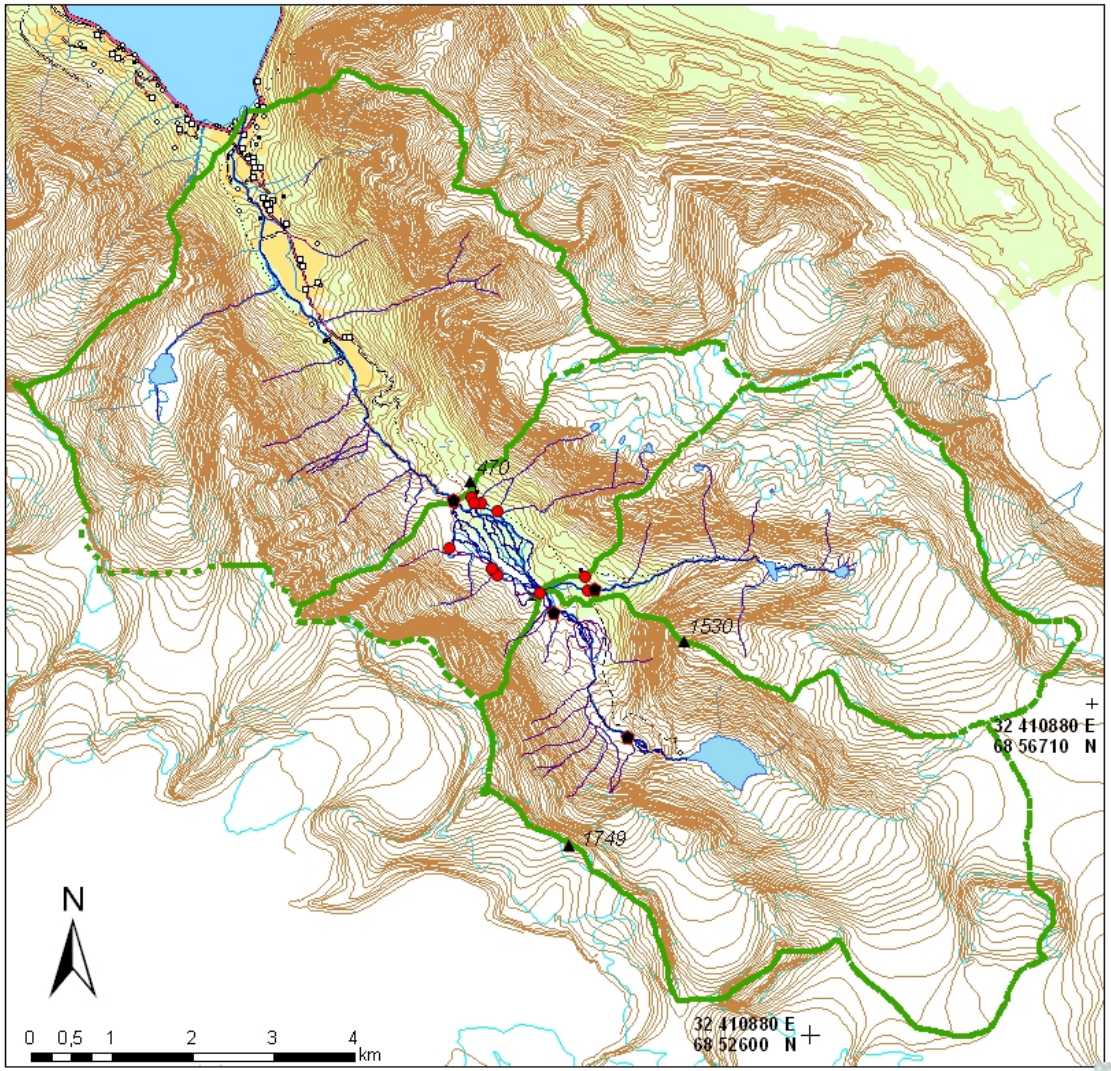
Study area

Map of Erdalen

Legend

- Stationary station
- Sampling point
- Water divide
- Water divide (glacier)
- Isoline, 20m distance
- Creek
- Temporary creek
- Hiking path
- Bridge
- Cabin
- Road
- House
- Glacier
- Lake
- Trees
- Bog
- Fields

Source: NGU Trondheim



NGU Geological Survey of Norway
1858 - 2008 · Geology for society since 1858
150

Erdalen (Photo: O. Fredin)

Braided sandur system at Sandane, Erdalen - viewing direction west / northwest (Photo: S. Liermann)

Aims and objectives

- The detection of different zones with negative, positive or balanced sub-recent (following the Little Ice Age advance) sediment budget within the braided sandur system

- The identification of sediment sources upstream of Sandane and at the slope systems to both sides of the braided sandur system

- The analysis of the sub-recent (following the Little Ice Age advance) sediment budget of the entire Sandane system

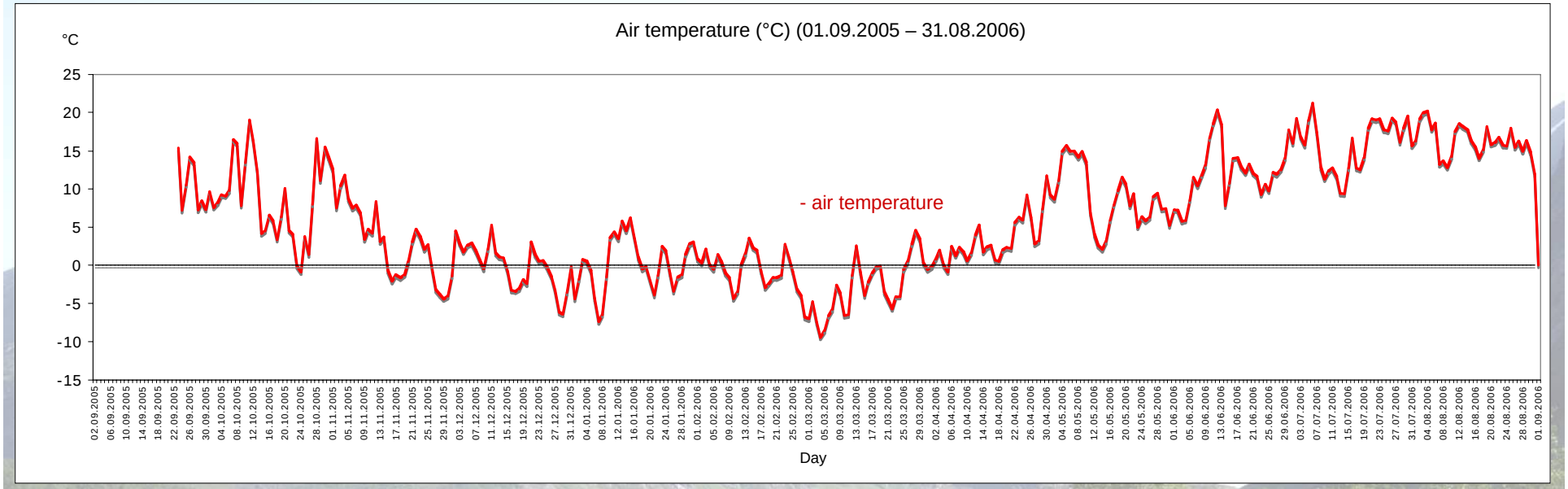
The Erdalen catchment is instrumented with an **automatic weather station** which provides continuous data on:

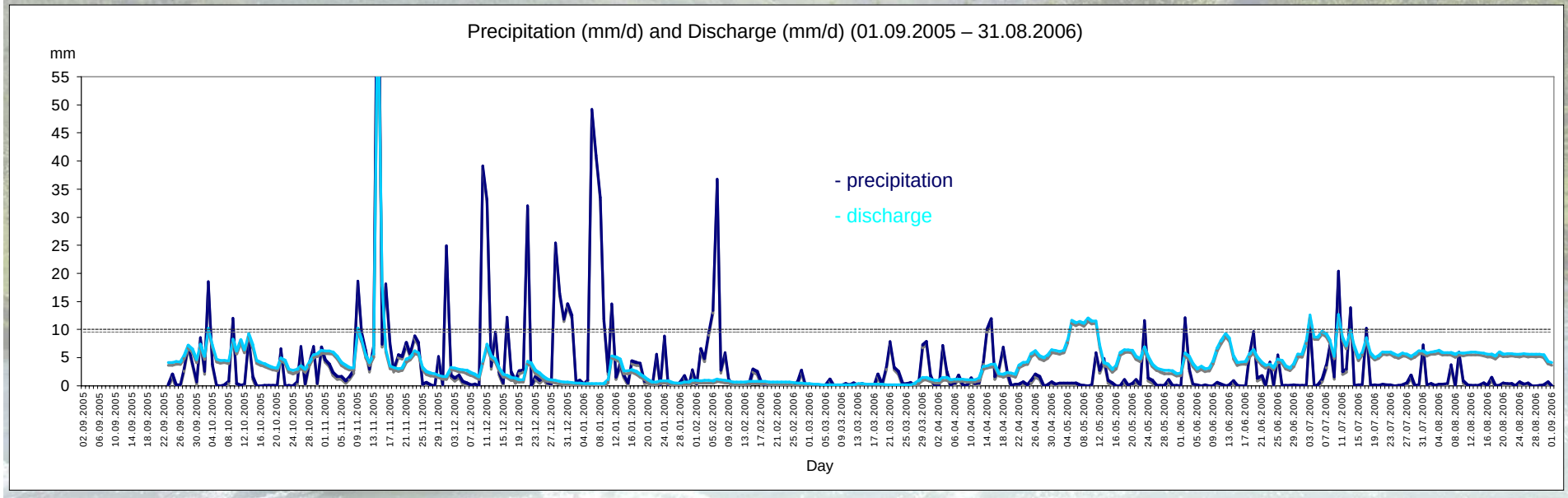
- wind speed and direction
- air temperature
- precipitation
- snow cover thickness
- ground temperature
- radiation

- Further **4 stationary gauging stations** are installed at the outlets of the different sub-catchments and the entire upper Erdalen catchment
- continuous year-round monitoring of runoff, fluvial suspended sediment and solute transport

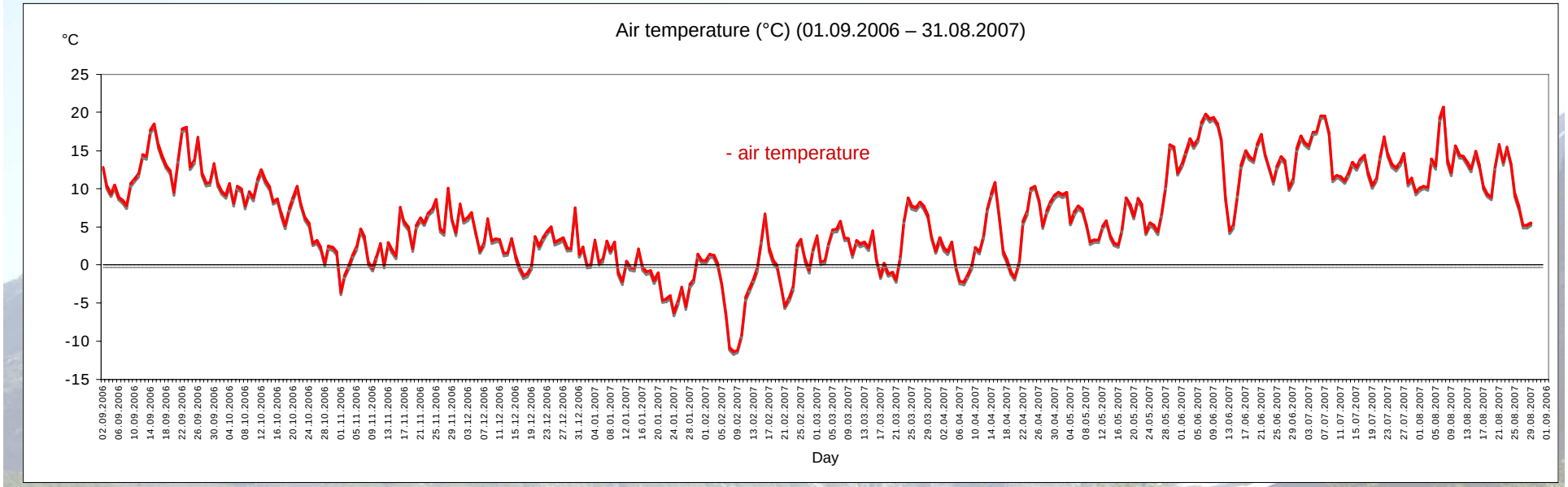
Photos: T. Lopez, K. Laute

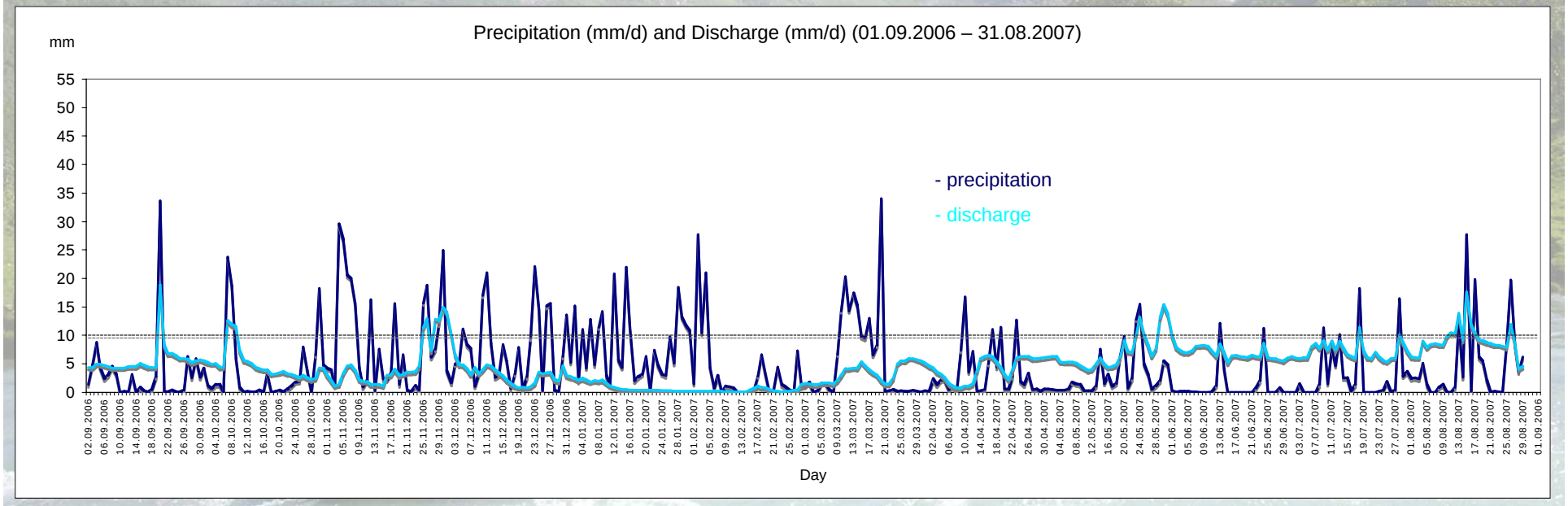
Mean air temperature, precipitation and discharge per day (2005 / 2006)



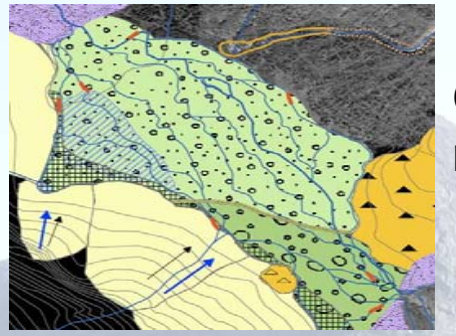


Mean air temperature, precipitation and discharge per day (2006 / 2007)





Research methods



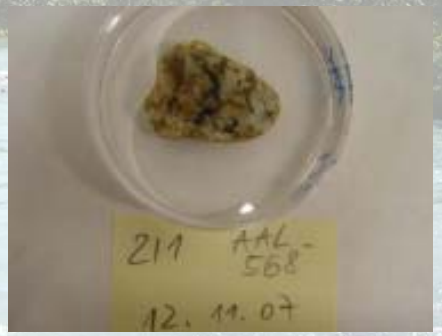
Geomorphologic mapping

Dendrochronology

Granulometric / morphometric analyses

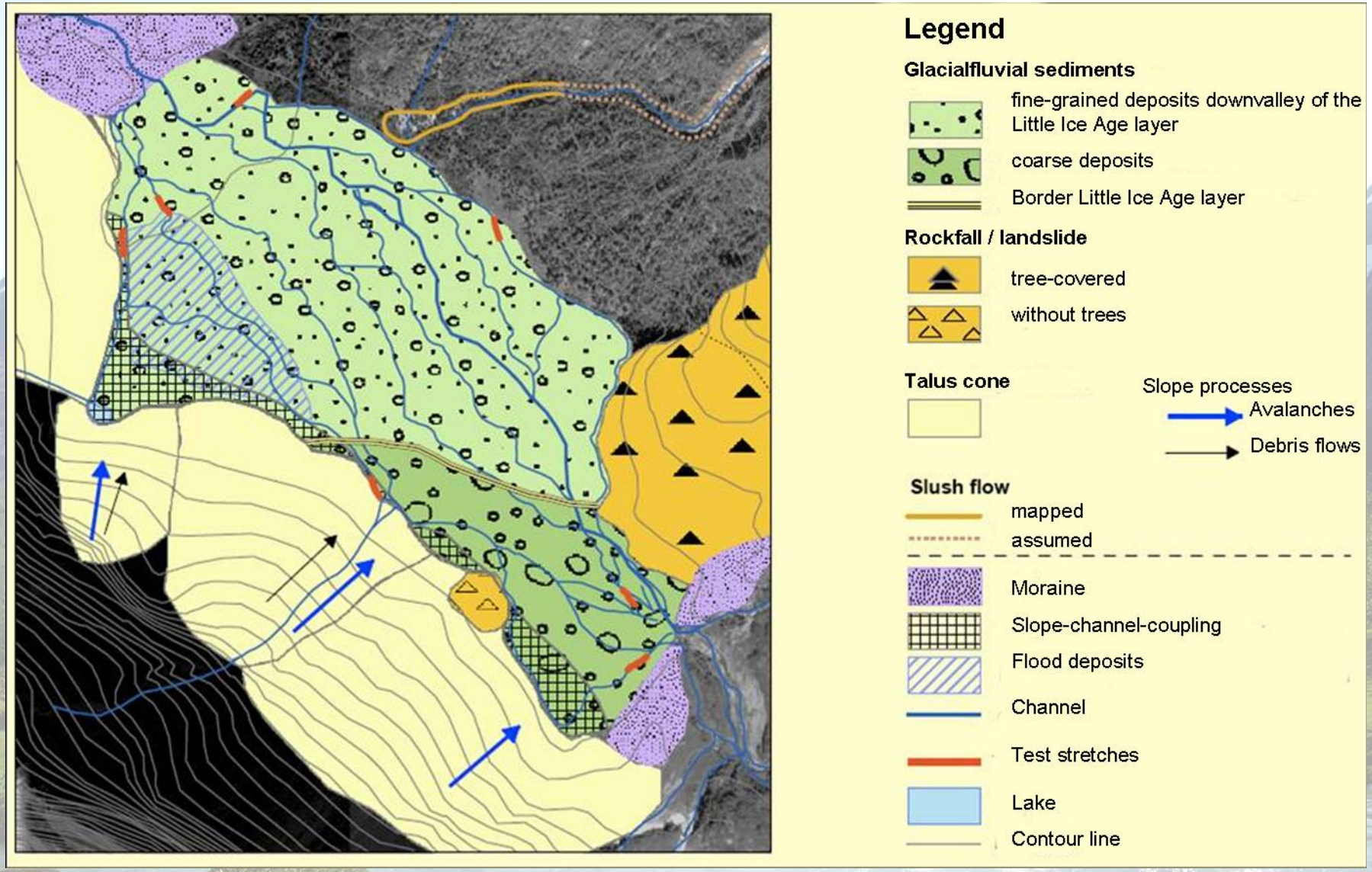
Shock sensors

^{14}C dating of flood deposits



Biofilm analysis

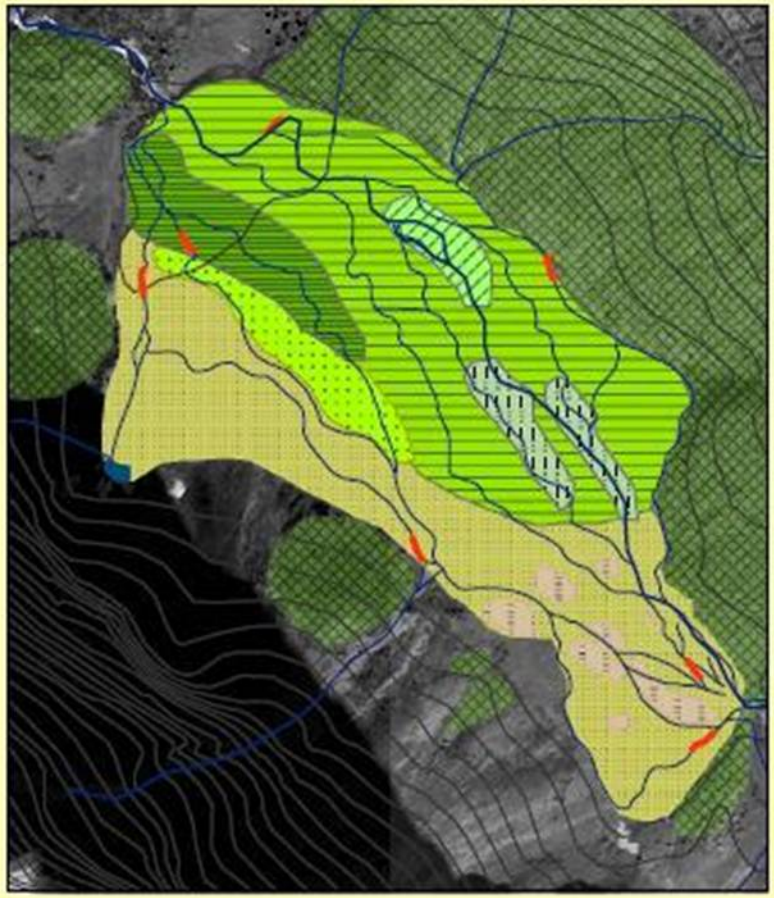
Geomorphological map of the braided sandur system



Author: Susan Liermann

Sources: Digital topographic map Nordfjord/Erdalen; NGU, Trondheim
Aerial photograph Erdalen 17.06.1983; NGU, Trondheim
Orthophoto Erdalen; NGU, Trondheim

Vegetation map of the braided sandur system



Legend

Nemoral forest of the braided sandur system / primary Grey Alder *(Alnus incana)*

- densely wooded with heights from 4.50m up to 6m
- less densely wooded with heights from 2.50m up to 4.50m
- stressed or damaged tree population
- high ratio of grass and shrubs low ratio of trees

- Grass, moss and lichen sporadic shrubs or trees
- Grass, moss, lichen
- Area of erosion processes

Vegatation slope/ primary Grey Alder (*Alnus incana*)

- Shrub- and tree population with heights up to 4.50m left slope and heights up to 6m right slope

- Channel
- Test stretches
- Lake
- Contour line

Meters
0 50 100 200 300 400

N

Author: Susan Liermann

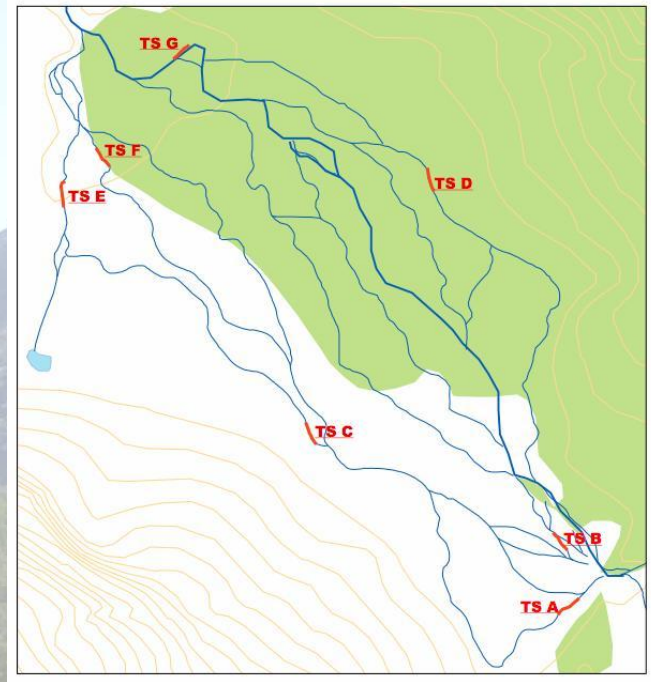
Sources: Digital topographic map Nordfjord / Erdalen; NGU, Trondheim

Aerial photograph Erdalen 17.06.1983; NGU, Trondheim

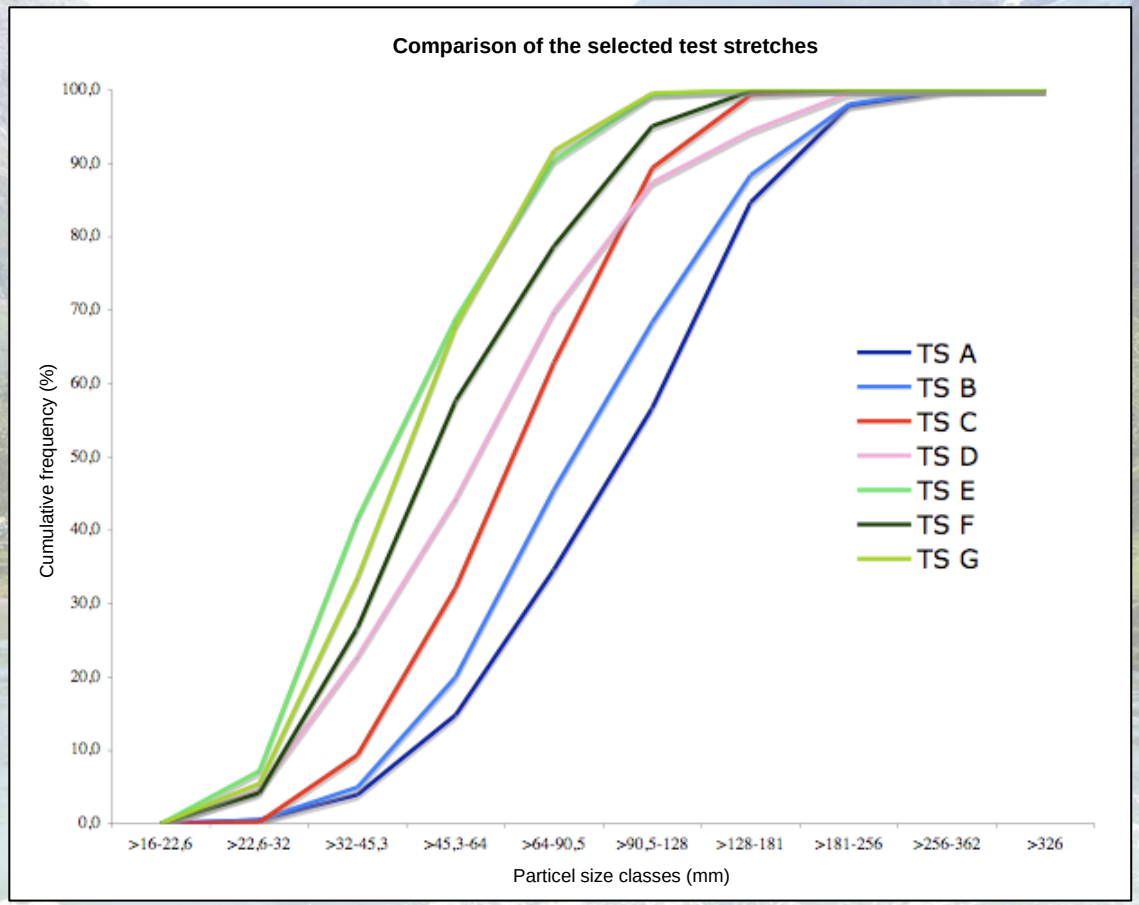
Orthophoto Erdalen; NGU, Trondheim

Granulometric / morphometric analyses

The particle size decreases with the increasing length of the streams as a result of the main factors of sediment-transport (discharge, flow velocity, slope etc.) and the effect of **downstream-fining**

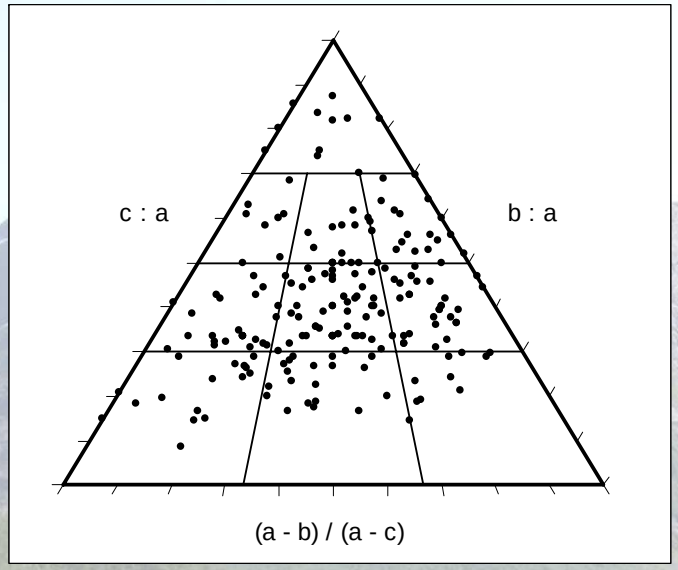


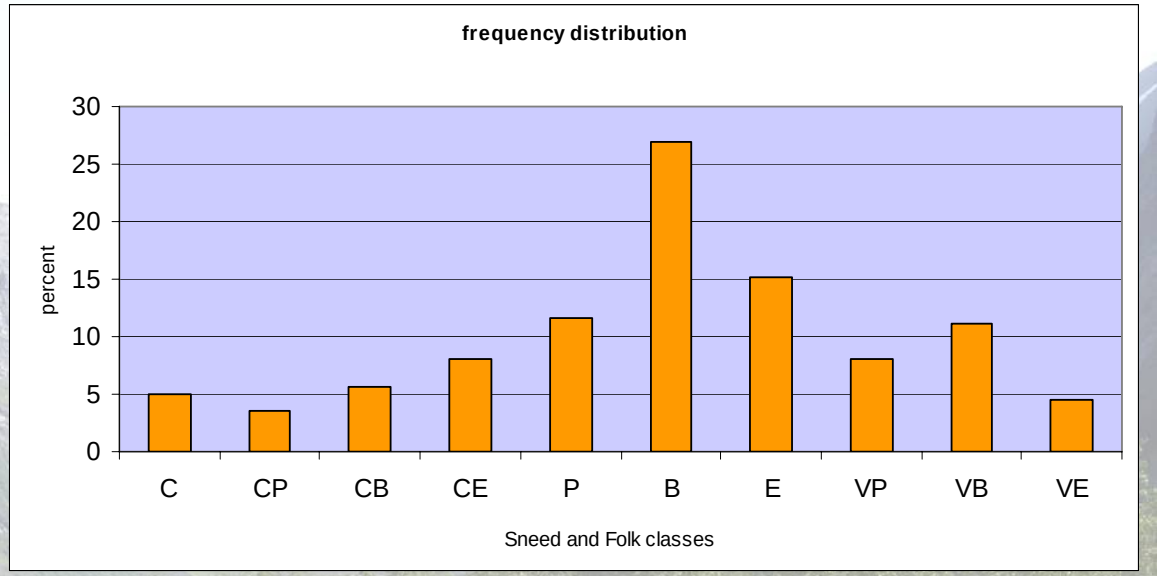
Overview of the seven selected test stretches and cumulative frequency distribution



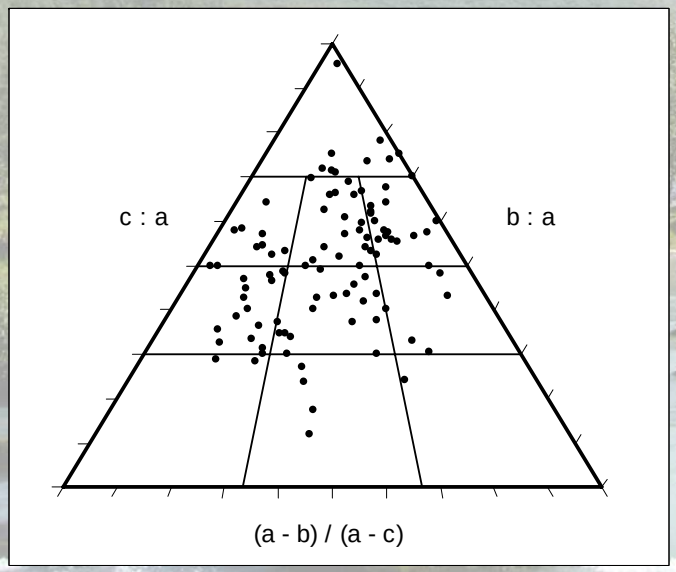
Shape analysis: Sneed and Folk triangular diagrams and frequency distribution of two selected test stretches

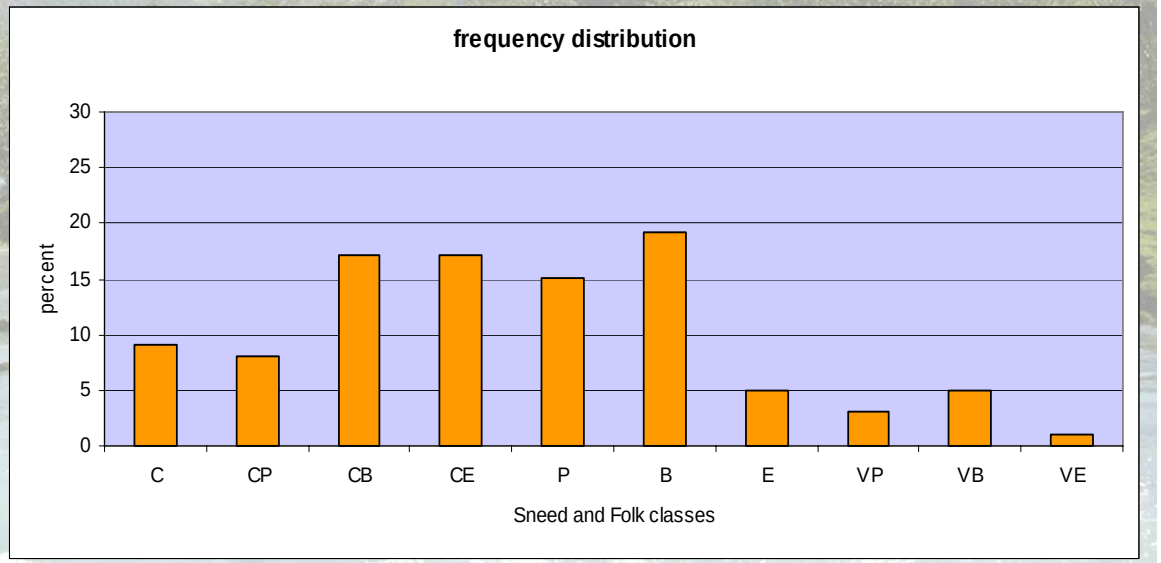
stretch Vesledalen





stretch Stordalen





	0
	0,1% - 4,0%
	4,1% - 8,0%
	8,1% - 12,0%
	12,1% - 16,0%
	> 16,1%

Determination of the particle roundness and flatness of two selected test reaches by using a visual 6-by-6 roundness matrix

sphericity - flatness

roundness - angularity

	VS	S	SS	SF	F	VF	
VA							VA
A							A
SA							SA
SR							SR
R							R
WR							WR
	VS	S	SS	SF	F	VF	

stretch Vesledalen

sphericity - flatness

roundness - angularity

	VS	S	SS	SF	F	VF	
VA							VA
A							A
SA							SA
SR							SR
R							R
WR							WR
	VS	S	SS	SF	F	VF	

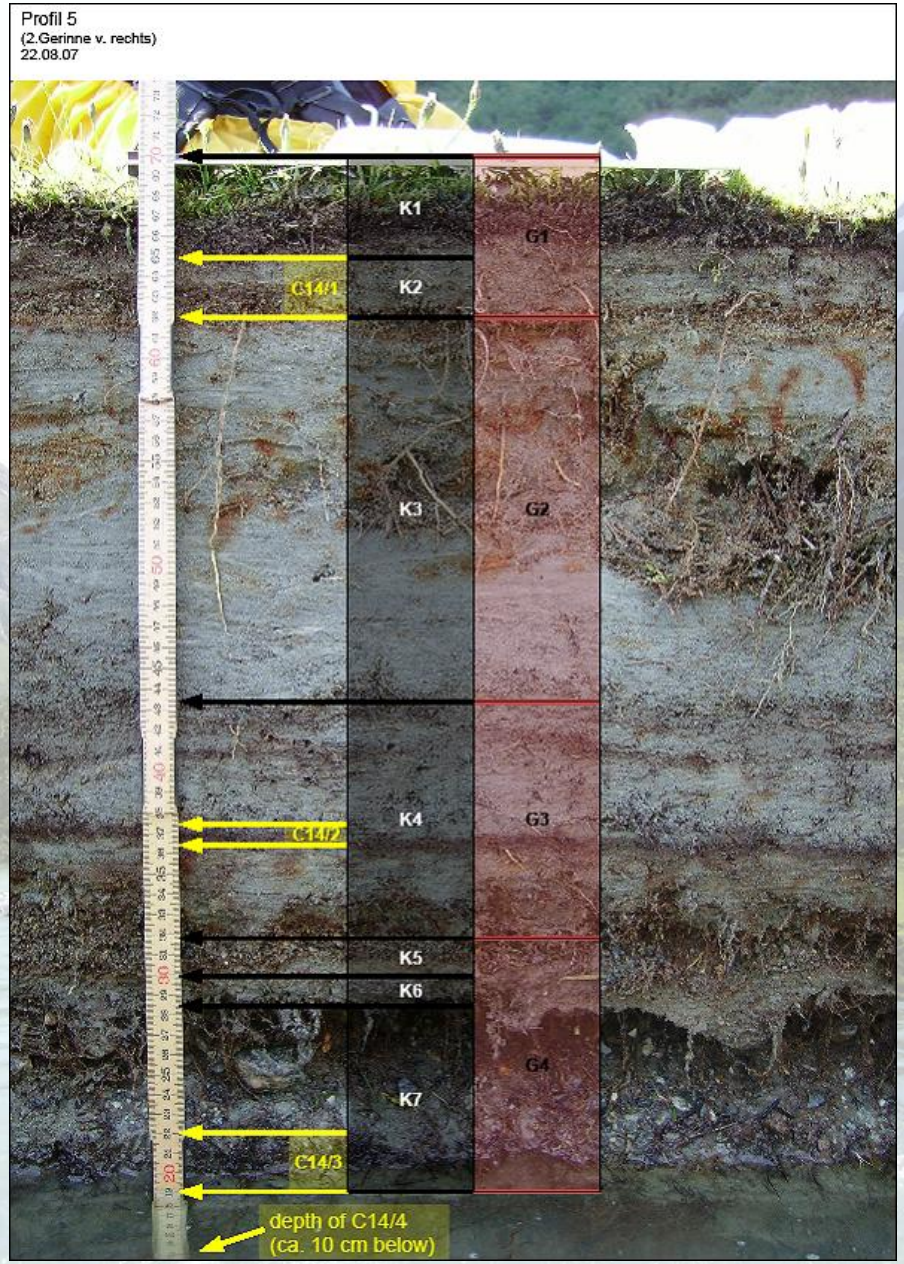
stretch Stordalen

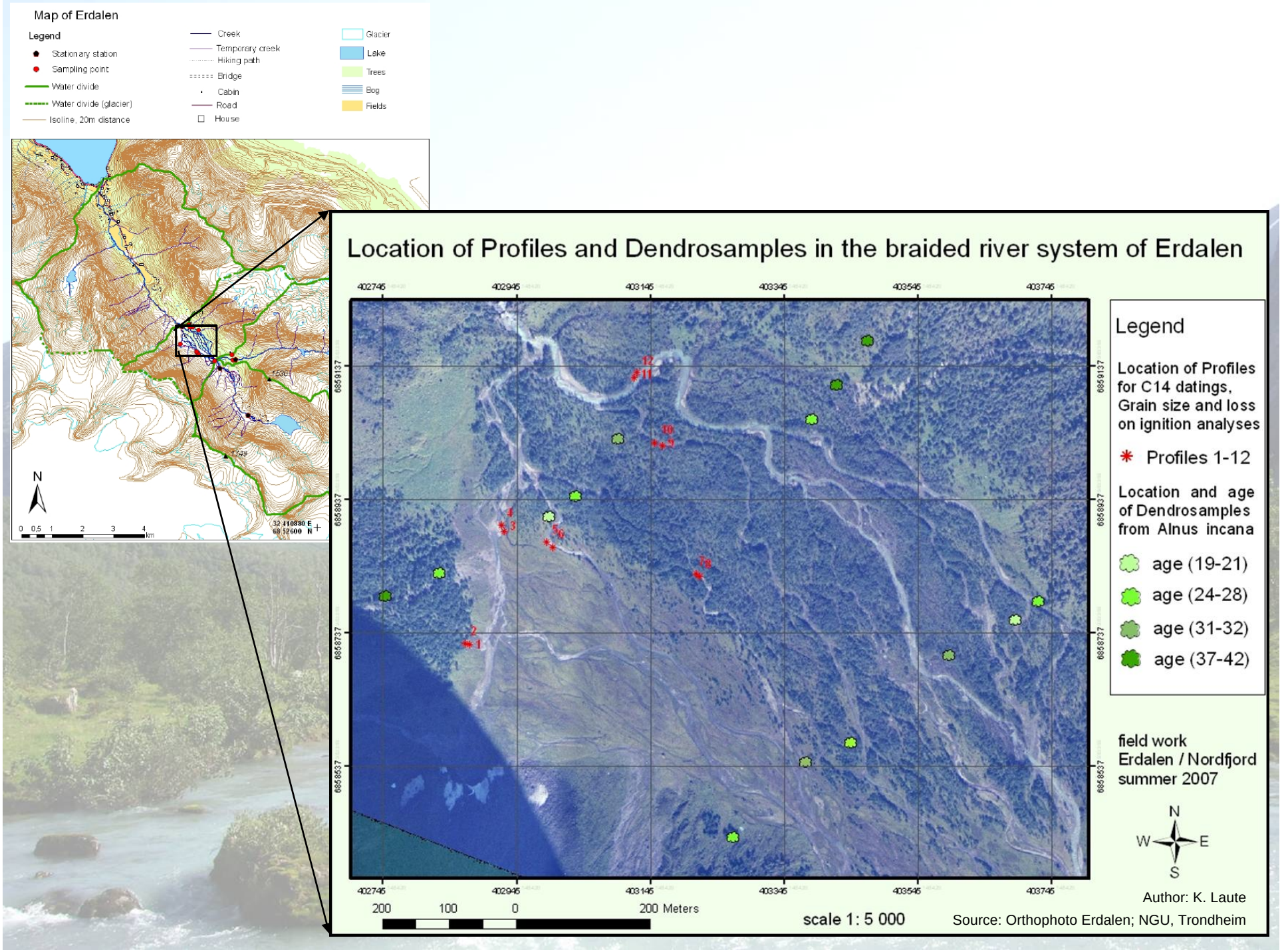
^{14}C dating of flood deposits

- At 6 profiles samples were taken for ^{14}C datings of the flood deposits in the lower part of Sandane
- Furthermore samples for grain size distribution and loss on ignition were taken at 12 profiles

- Regarding dendrochronology samples were collected from the predominant species alnus incana

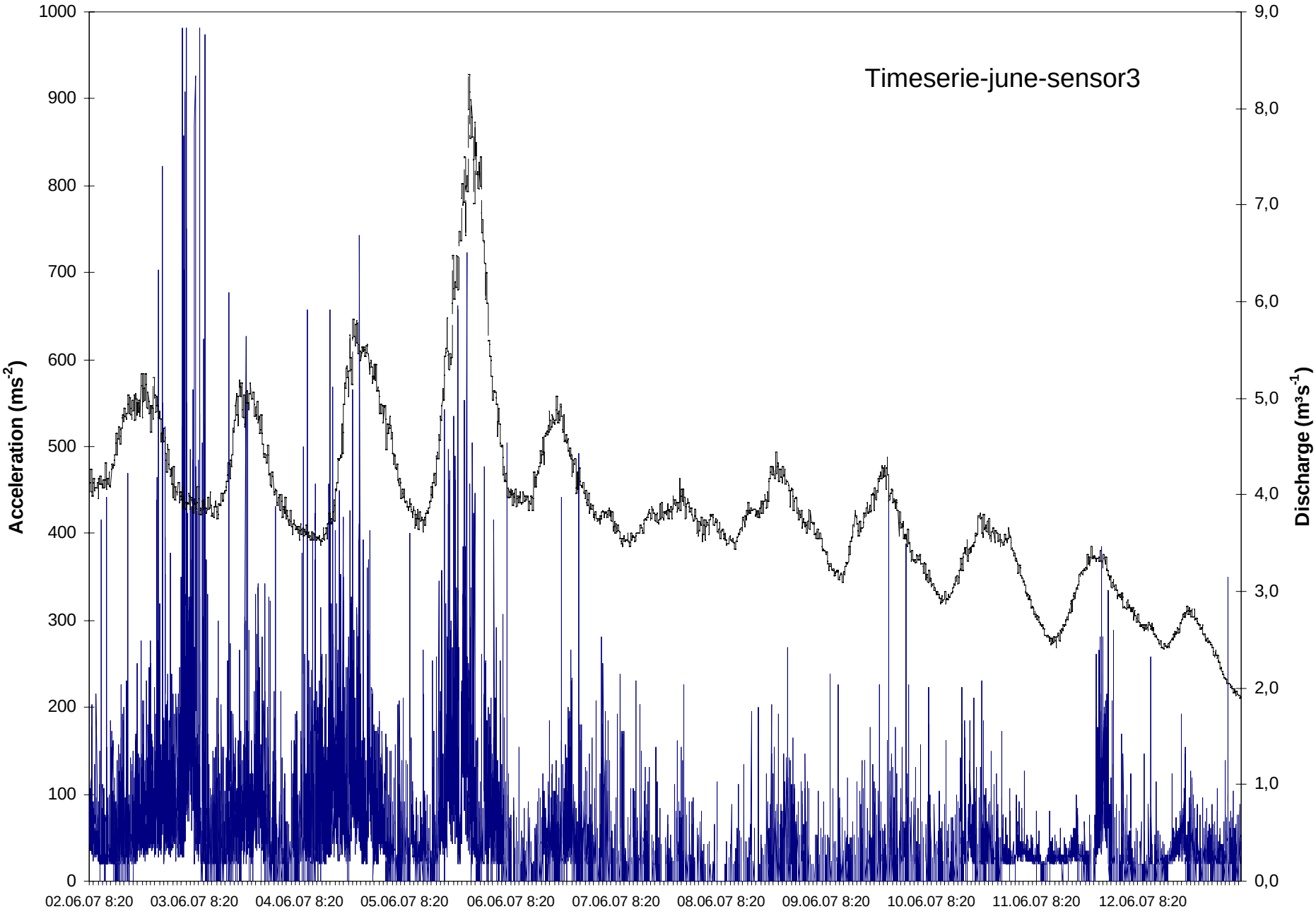
Photos: K. Laute




Map of Erdalen
Legend
Stationary station
Sampling point
Water divide
Water divide (glacier)
Isoline, 20m distance
Creek
Temporary creek
Hiking path
Bridge
Cabin
Road
House
Glacier
Lake
Trees
Bog
Fields
N
0 0,5 1 2 3 4 km
Location of Profiles and Dendrosamples in the braided river system of Erdalen
402745
402945
403145
403345
403545
403745
6859137
6858937
6858737
6858537
Legend
Location of Profiles for C14 datings, Grain size and loss on ignition analyses
Profiles 1-12
Location and age of Dendrosamples from Alnus incana
age (19-21)
age (24-28)
age (31-32)
age (37-42)
field work
Erdalen / Nordfjord
summer 2007
N
W
E
S
200 100 0 200 Meters
scale 1: 5 000
Author: K. Laute
Source: Orthophoto Erdalen; NGU, Trondheim

Shock sensors

Photos: G. Vatne


Timeserie-june-sensor3
Acceleration (ms-2)
Discharge (m3s-1)
1000
900
800
700
600
500
400
300
200
100
0
9,0
8,0
7,0
6,0
5,0
4,0
3,0
2,0
1,0
0,0
02.06.07 8:20
03.06.07 8:20
04.06.07 8:20
05.06.07 8:20
06.06.07 8:20
07.06.07 8:20
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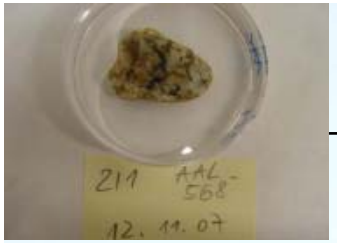
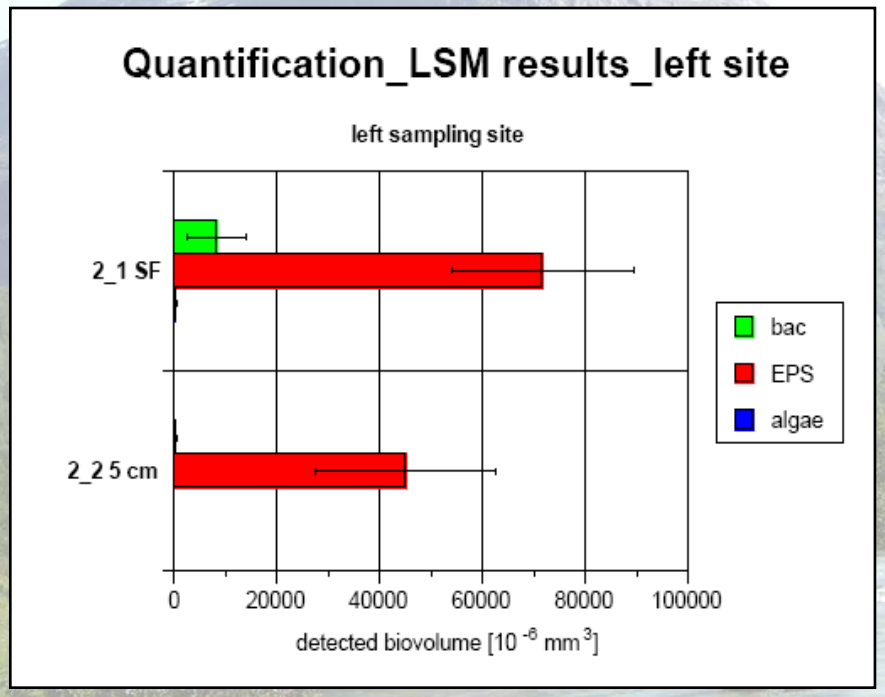
10.06.07 8:20
11.06.07 8:20
12.06.07 8:20

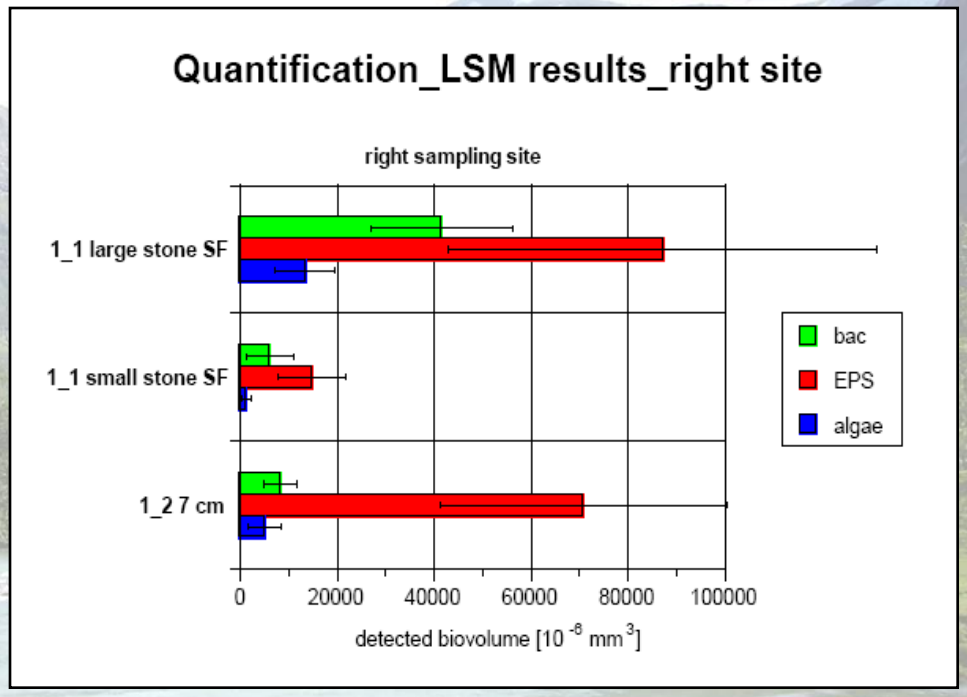


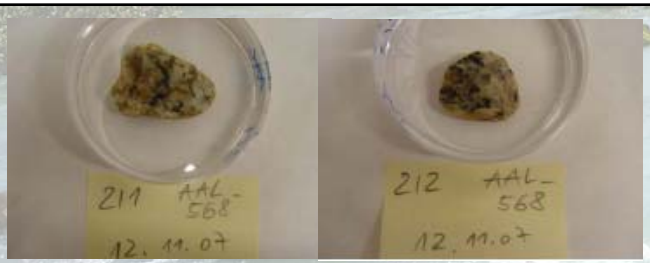
Biofilm analysis

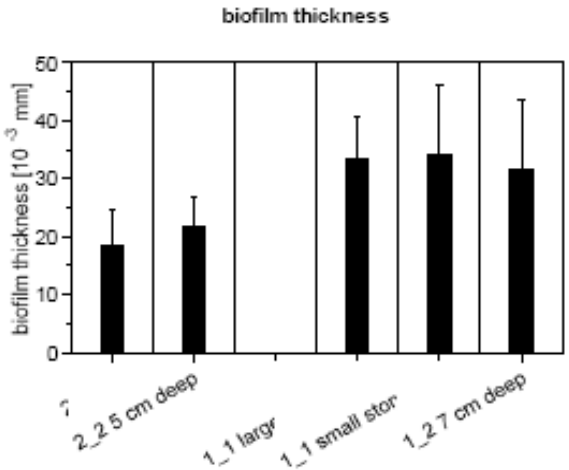
Photo: A.A. Beylich

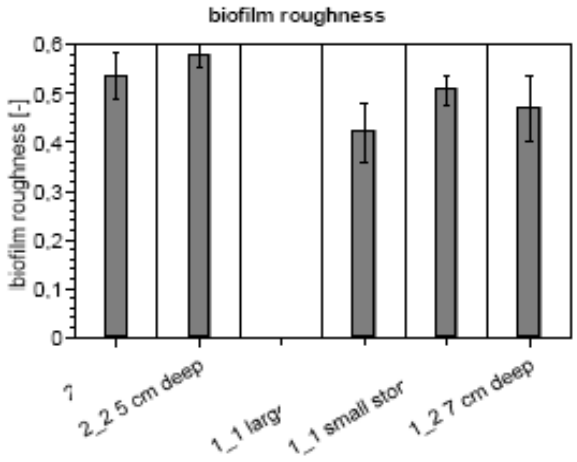
Photo: D. Gintz





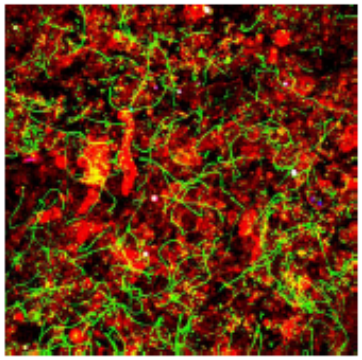


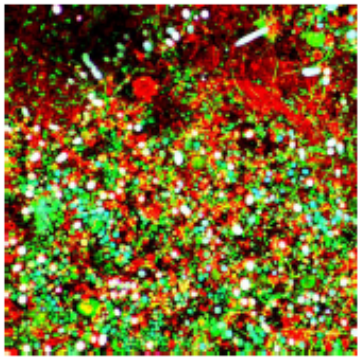




MIP biofilm

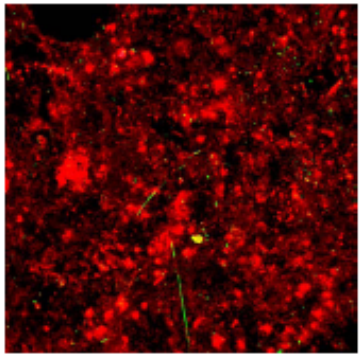
left surface

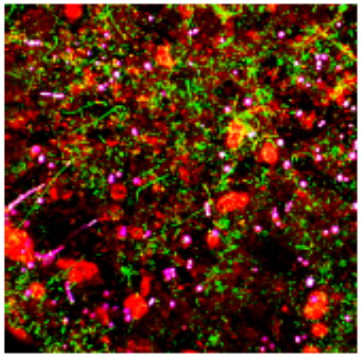




right surface

left 5 cm deep





right 7 cm deep

Conclusions

- The upper part of Sandane is characterised by a negative sub-recent sediment balance, with erosion of coarse sediments from the Little Ice Age advance and downcutting of channels (small width/depth ratio)

- In comparison, the lower part of Sandane has a balanced to slightly positive sub-recent sediment budget with formation of younger flood sediments and more stable channels

- Present-day coupling of slope and fluvial systems is limited and only a rather small amount of material is directly transported from the slopes into the braided sandur

- Apart from flood deposits, material is only temporally stored in channels in the lower part of Sandane before export during peak-runoff

- Altogether, the sub-recent sediment budget of Sandane, following the Little Ice Age advance, appears to be slightly negative and fluvial sediment transport is supply-limited