Nival moraine – unclassified dry-climate periglacial sediment Example from Pamiro-Alay Mts.

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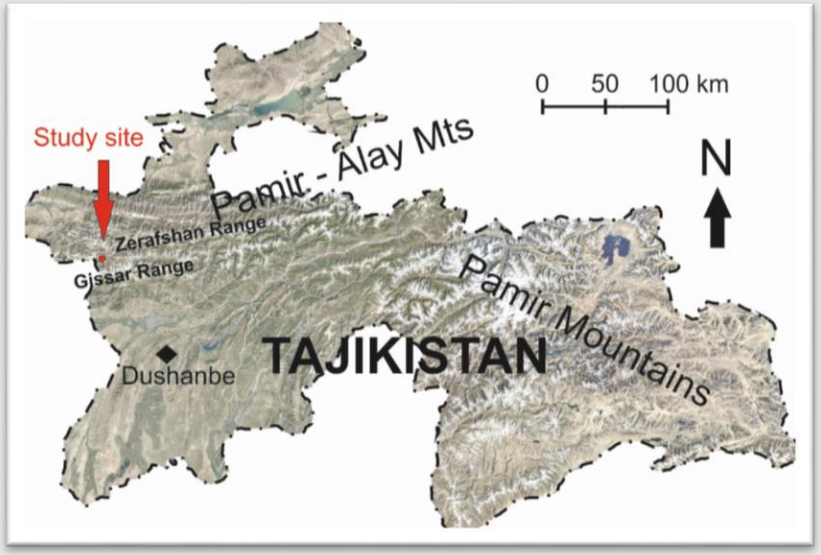
Study site

Pamiro-Alay, Fann Mts.



Two forms
„form A”
„form B”

Short overview of valley system

Study site, ~2400 m a.s.l.

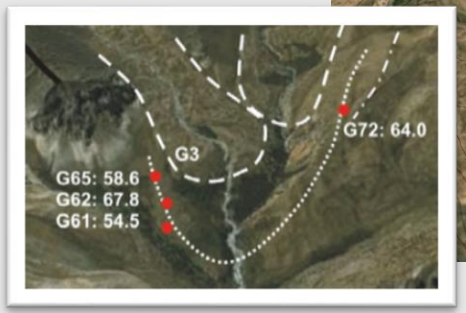
Fluvial valley

Alluvial fen (fluvio-glacial material)
~ 2500 - 2450 m a.s.l.

Fluvial valley

Glaciers maximum
~ 2700 m a.s.l.

Moraine boulders dating
(Zach et al. 2013)

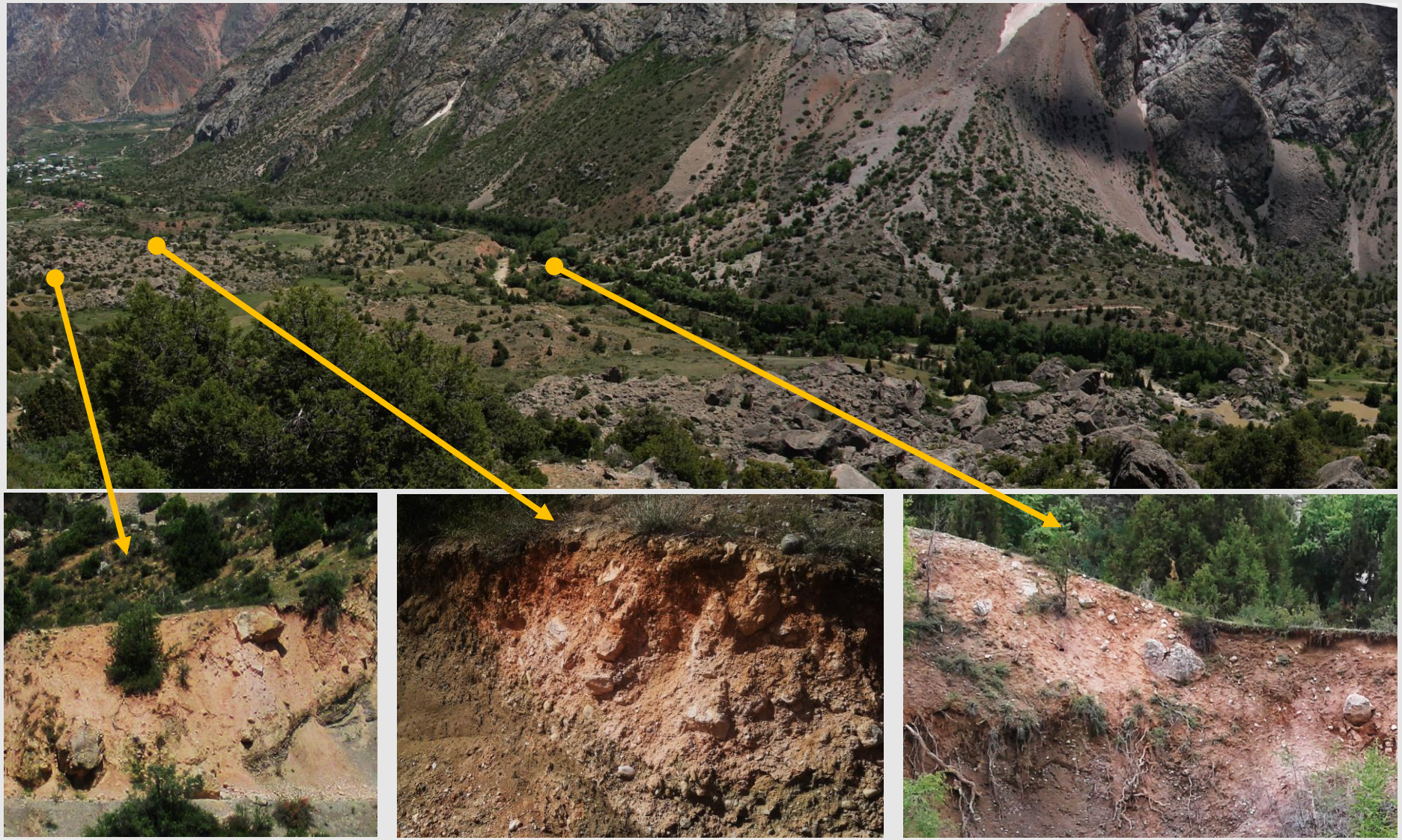


3904 m n.p.m.

Photo by GoogleEarth Pro

Phisignomy of deposits

- only local material, no erratics
- sediments with various grain sizes
- prevalence of sands and gravels
- locally boulders and bigger stones



Diagnostic criteria

For pronival rampart and protalus rock glacier

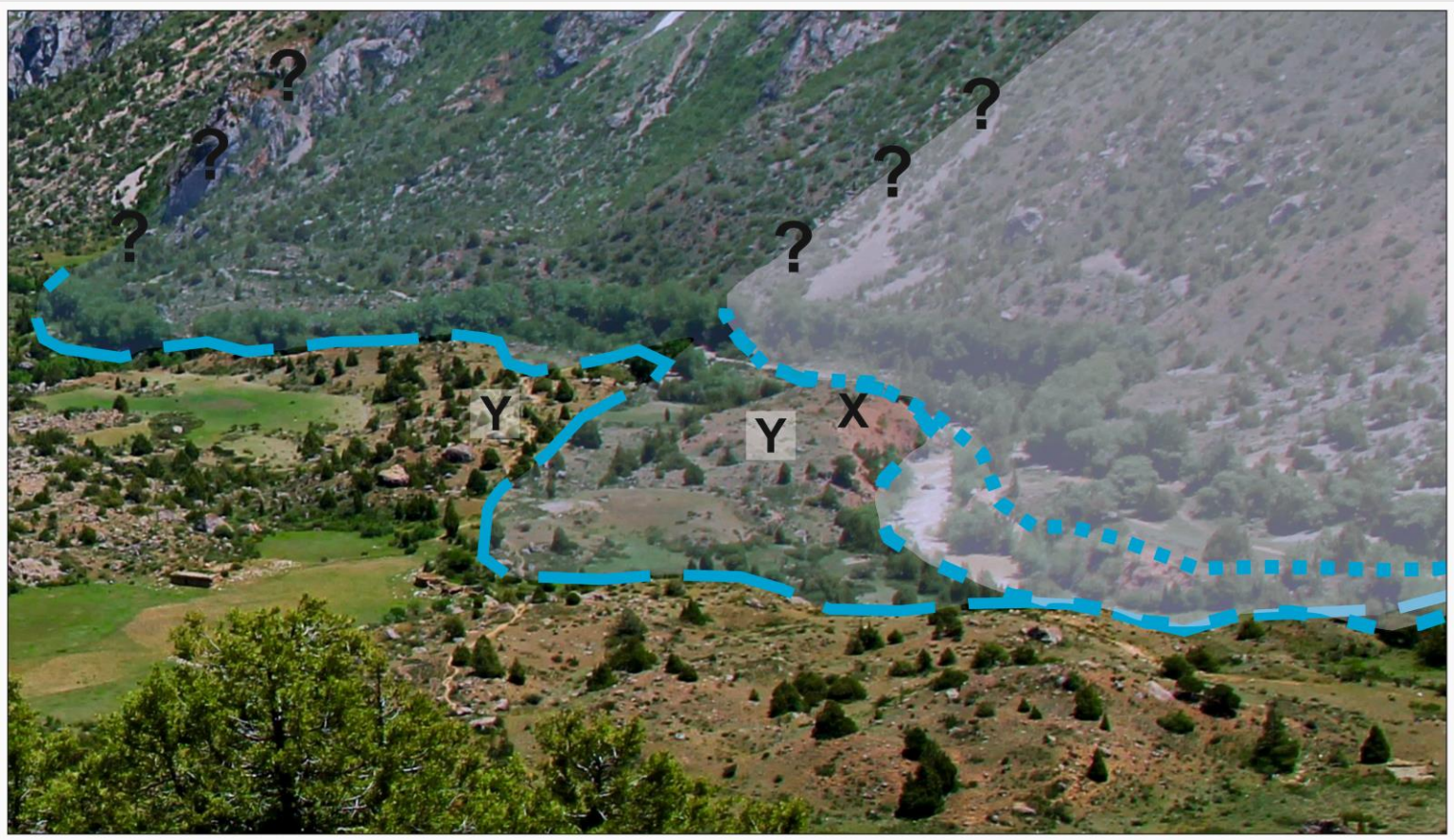
Hedding & Sumner 2013

PRONIVAL RAMPART	Form A	Form B
Ridge crest to cliff-foot distance < ~30–70 m	NO	NO
Insufficient cross-section depth for snow to glacier ice transformation	YES	YES
Underlying slope gradient that will facilitate snow/firn bed angle > 20°	NO	NO
No glacial erosional forms or evidence of overdeepening of the associated backwall area through sapping and subglacial erosion	YES	YES
Openwork fabric; absence of fines (<2 mm)	NO	NO
Wall and ridge same lithology (no erratics)	YES	YES
Absence of striated clasts	YES	YES
No of criteria	4/7	4/7
PROTALUS ROCK GLACIER		
Greater in length (down slope) than in width (across slope)	NO	NO
Convex distal slope	NO	NO
Typically terminate >70 m from the talus slope	YES	YES
Lobate or crenulated of the outer margins in plan form	NO	NO
Meandering and closed depressions, downslope ridges and furrows, and transverse ridges and depressions *(one closed depression on form B, but other orgin)*	NO	NO/YES
No of criteria	1/5	1,5/5

Most important sediment features

- Nival mechanism of material transport and deposition
  - but: deposits are not like pronival ramparts
- Moraine-like physiognomy and type of deposits;
  - but: deposits are lying on fluvial terraces (no glacial erosional forms or evidence of overdeepening)
- Only local material
- Prevalence of sands and gravels; absence of striated clasts
- Big size of the form (sediments on area much bigger than pronival ramparts)
- Moraine-like physiognomy suggest, that material was deposed on the flat snow cover and then weathered (so: snow bed was very long-time occuring)

Interpretation of relief



Maximum range of diagonal snow patch

Other stages of diagonal snow patch

? Signs of nivation covered by talus slopes

X Maximum depth of nival moraine

Y Two of five patches of nival moraine that have a clear form of rampart

Mechanism of deposit formation

Processess:

1) Deposition on flat snow bed
2) Long-time physical and chemical weathering of deposed material on the snow

„morenisation” of material

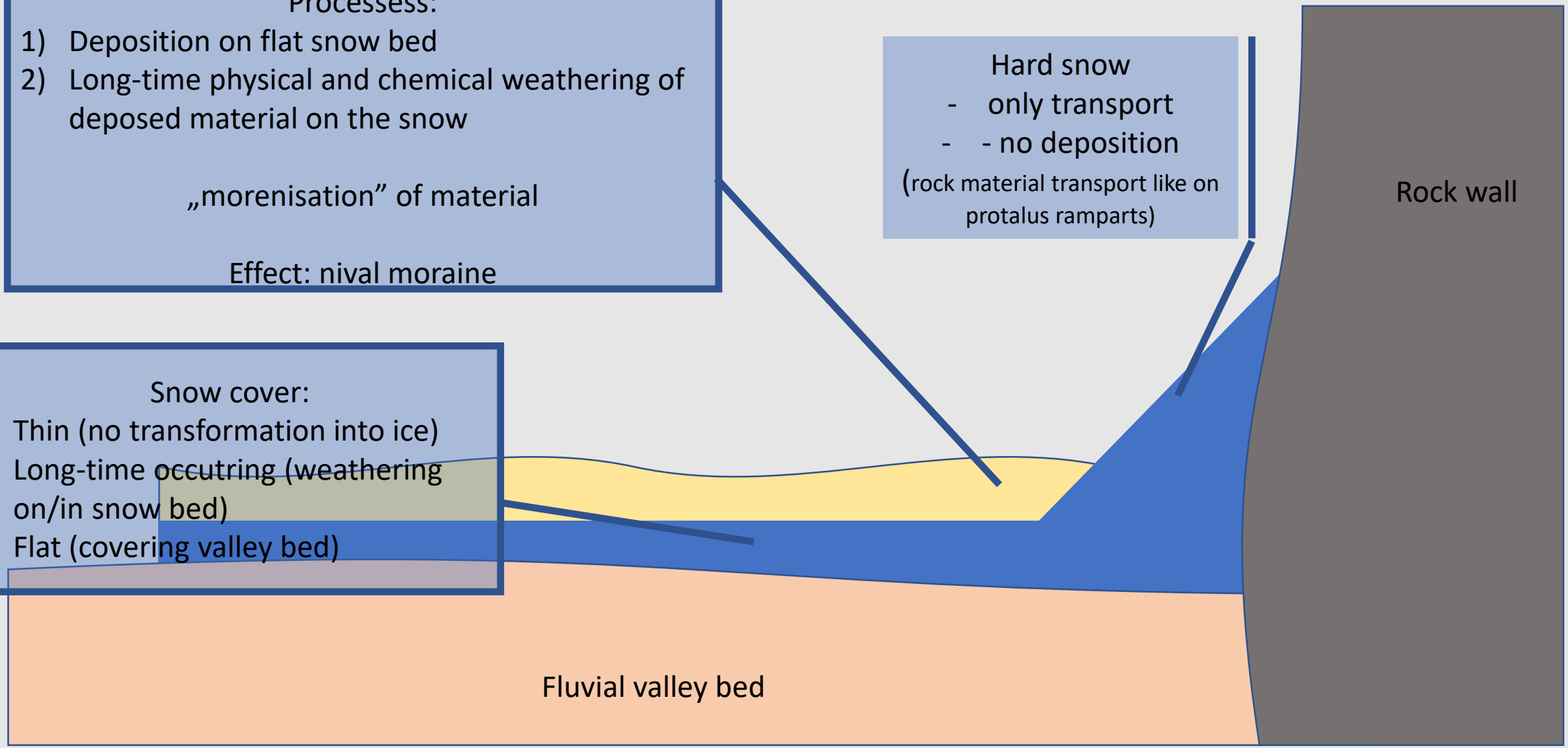
Effect: nival moraine

Hard snow
- only transport
- - no deposition

(rock material transport like on protalus ramparts)

Snow cover:

- Thin (no transformation into ice)
- Long-time occutring (weathering on/in snow bed)
- Flat (covering valley bed)



Nival moraine – propose of defining

- Sediment (and the terrain form) - a result of the accumulation of local material delivered to the valley bed from the surrounding rock slopes by nival mechanisms and accumulated on a long-lasting small thickness snow bed, where weathering („morenisation”) have been occurring.

The distinguishing features of this sediment are:

1) a diverse fraction of material typical for moraine sediments,
2) no erratics, only local material,
3) no traces of glacial erosion,
4) occurrence in dry and cold climate, in which there was a small supply of snow, but snow cover is long-time occuring.

Thank you for attention,

I’m looking forward comments

- during EGU2020 online session
- and later on e-mail: pawel.kroh@up.krakow.pl