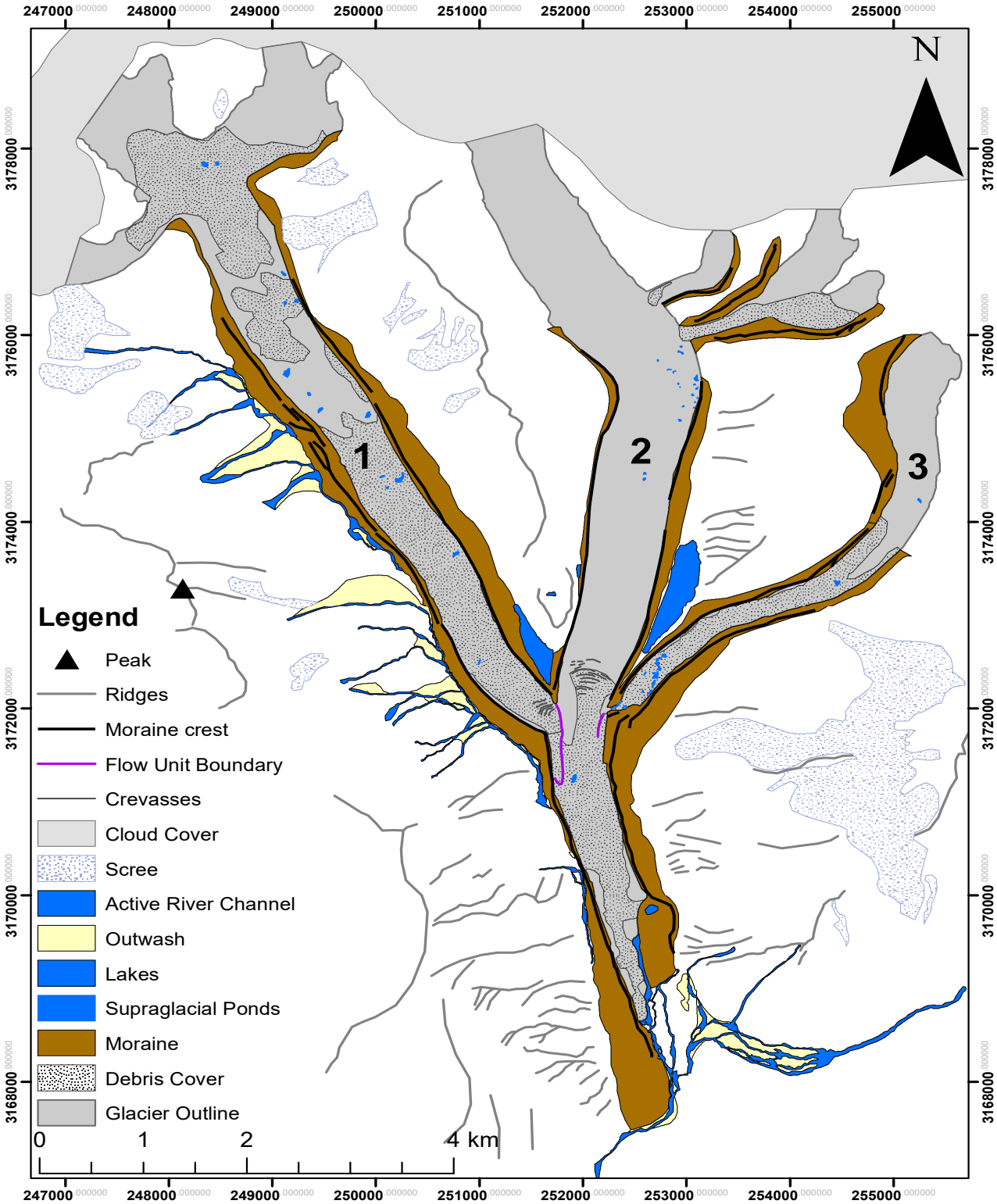
The geomorphology of debris-covered Ponkar Glacier, Nepal

Neil F. Glasser, Adina Racoviteanu, Stephan Harrison, Matthew Peacey, Rakesh Kayastha & Rijan Bhakta Kayastha

Questions to: Neil Glasser (nfg@aber.ac.uk)

Ponkar Glacier - Introduction

- Understanding the evolution of debris-covered glaciers in High Mountain Asia is important for making informed projections of climate change impacts as well as associated water security and hazard-related issues. Our overarching aim is to understand the evolution of the different components of debris-covered glacier surfaces through time
- As part of a larger project (IGCP 672 - see poster by Racoviteanu et al. **EGU2020-22638**), in November 2019 we undertook fieldwork and training on Ponkar Glacier, a debris-covered glacier in the Manaslu area of Nepal to characterize sediments and landforms on the debris-covered surface
- We constructed a high-resolution geomorphological map from 2019 RapidEye satellite images (5 m resolution)
- Here we present the key features of Ponkar Glacier and its ice surface morphology: the debris cover characteristics, supraglacial ponds, ice cliffs, crevasses and vegetation



Geomorphological map of Ponkar Glacier, Nepal based on 2019 Rapid Eye image. Numbers 1-3 indicate glacier flow units.

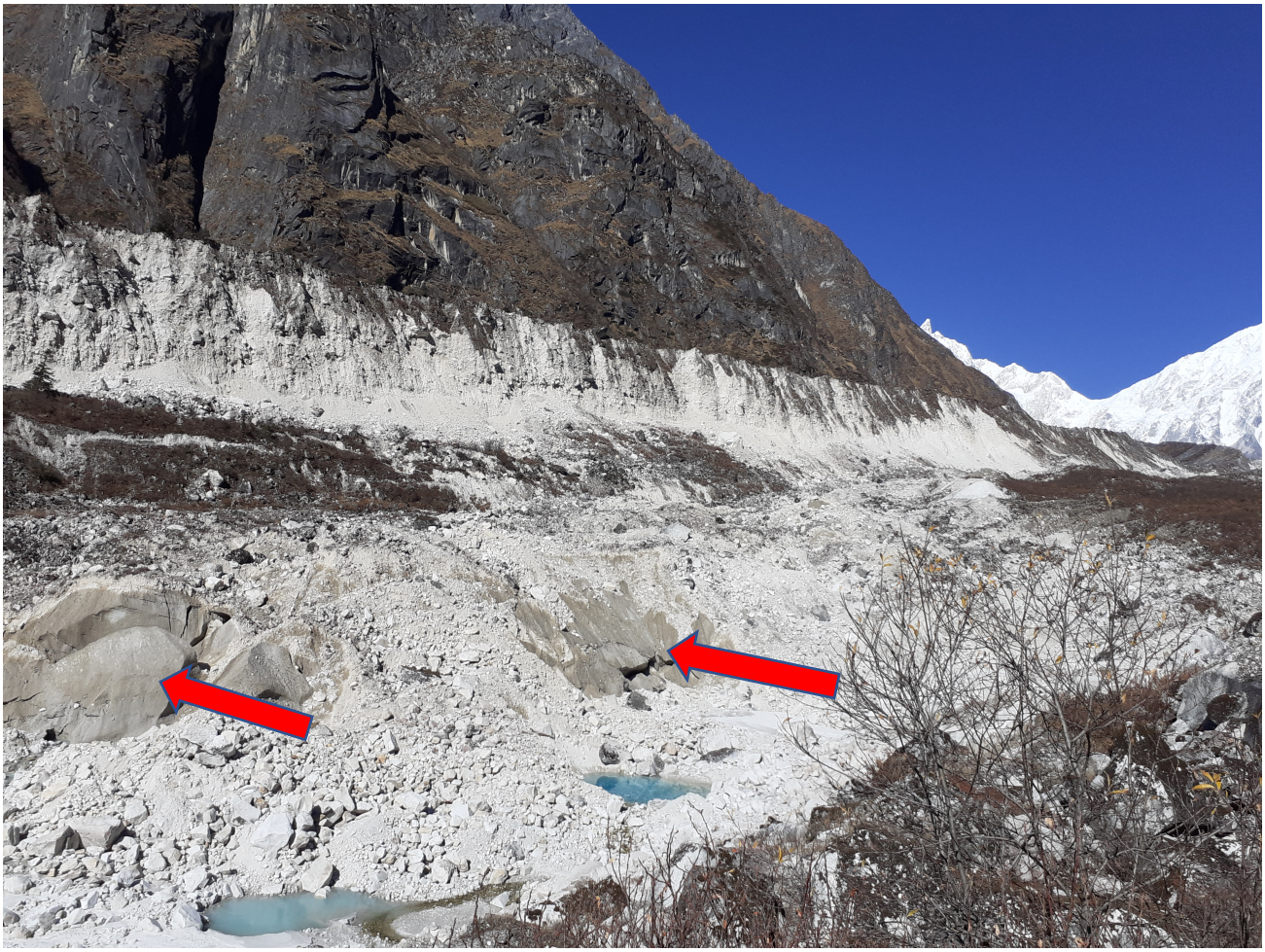
Overview photographs of Ponkar Glacier in November 2019

View looking up-glacier from the large terminal moraine. Note the steep inner faces of the outer lateral moraines and the breach in the terminal moraine (arrowed), through which the proglacial stream now drains. The contemporary glacier surface (barely visible) is 90-100m below the elevation of the outer moraines.

Overview photographs of the glacier taken in November 2019

View looking down-glacier from near Ponkar Lake. Note the steep, degrading inner faces and more gentle, vegetated outer face of the lateral moraines. The contemporary glacier surface is 90-100m below the elevation of the outer moraines. Note also the large ‘ablation valley’ containing the village of Bimthang (arrowed) on the left of the photograph.

Glacier ice exposed (arrows) at the snout of Ponkar Glacier in November 2019



The exposed glacier ice represents the position of the glacier snout in November 2019. Note the debris cover on the glacier surface and pond development. The contemporary ice surface is 90-100m below the elevation of the outer moraines

Large outer moraine at Ponkar Glacier

The outer moraines are composed of diamicton and have steep, degrading inner faces and gentle, vegetated outer faces. The foreground shows the partly vegetated surface of Ponkar Glacier

Inner moraine at Ponkar Glacier

The inner moraines are composed of sandy boulder gravel with steep, rapidly degrading inner faces. Lines of boulders often mark their crests

Diamicton exposed in inner face of true-left lateral moraine

The outer moraines are composed of diamicton with clay or silt matrix. Clasts are typically subangular and subrounded and composed of local lithologies.

Sandy boulder gravel exposed in inner face moraine

The inner moraines are composed of silty or sandy boulder gravel. Clasts are typically subangular and subrounded and composed of local lithologies.

Summary

Geomorphological mapping conducted at Ponkar Glacier from satellite images and in the field indicates a landsystem composed of:

- **Moraines** – divided into large outer lateral moraines and smaller inner moraines. The large outer moraines are separated from the valley side by ‘ablation valleys’. Moraines have steep, rapidly degrading inner faces and **mature vegetation** including trees on their outer flanks. Moraines are typically composed of diamicton and silty or sandy boulder gravel.
- A **large proglacial stream** with both active and abandoned outwash plains.
- **Ice-marginal ponds** and **supraglacial ponds** developed in and around the glacier.

The sediments and landforms are closely related to the debris transport history in each of the three ice-flow units.

Acknowledgements

- Financial support for travel and field logistics of Glasser and Racoviteanu was provided by a GCRF (Global Challenges Research Fund) Agility Grant through CIDRA (Centre for International Development at Aberystwyth University).

- Participation of Nepalese and Indian students on the fieldwork training at Ponkar Glacier was supported financially by UNESCO IGCP Project 672: *"Himalayan Glaciers and risks to local communities"* (see poster **EGU2020-22638).** We thank all fieldwork participants for their hard work and enthusiasm.

- Adina Racoviteanu is supported by a Fellowship through the Marie-Curie COFUND Ser Cymru II scheme.

- Fieldwork logistics on Ponkar were organized by Himalayan Research Expeditions in Nepal.

- RapidEye images were provided at no cost from Planet Labs (www.planet.com)

.