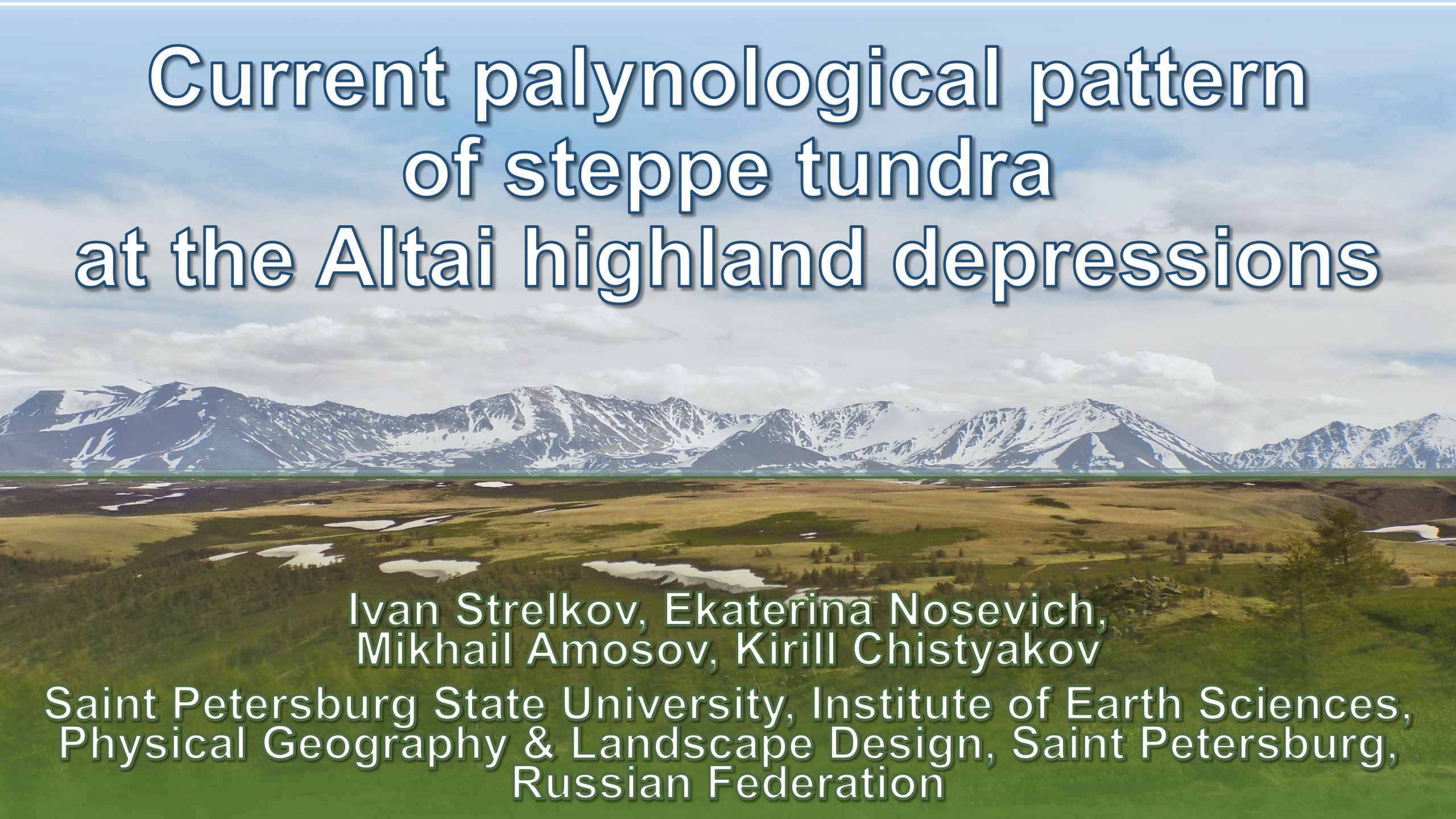
Current palynological pattern of steppe tundra at the Altai highland depressions



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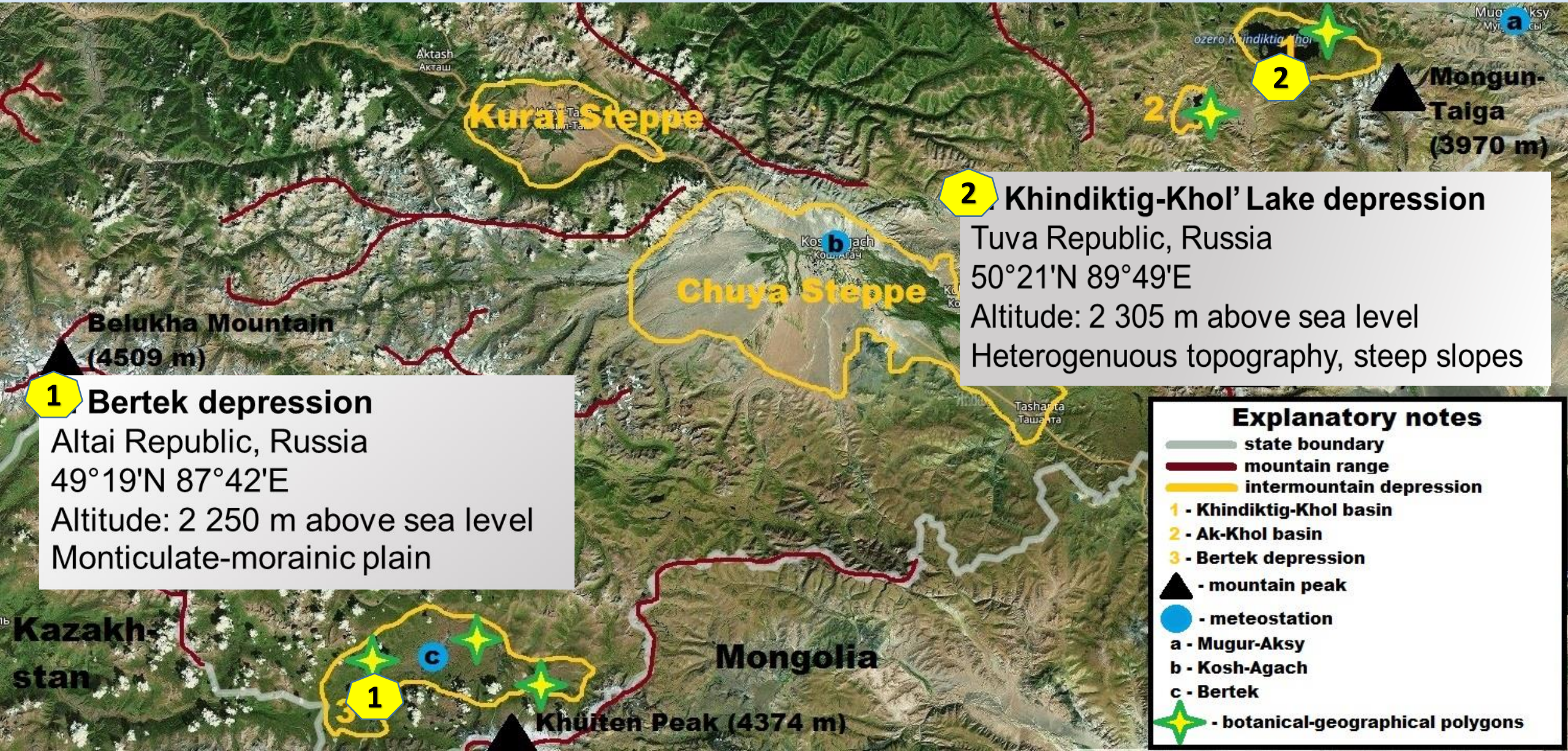
Introduction

- Steppe-tundra (mammoth steppe) was the most extensive biome of Northern Eurasia during Quaternary glaciations.
  It disappeared during the Holocene

- Today the tundra, cold steppe communities and their mixture are found in Altai mountains

Aim of the research: to find the current analogs of Late Pleistocene steppe-tundra in the Altai highlands by comparing palynological and climate conditions of investigated area with LGM data of Northern Eurasia

Investigation Area



Materials and Methods

- **Two expeditions on the Altai mountains**:
  June 15 – July 14, 2018;
  July 15 – August 7, 2019
- During the palynological study **75 samples** were collected for pollen analysis:
  - ✓ 56 – subfossil
  - ✓ 13 – flower buds
  - ✓ 6 – recent
- Landscape description
- Pollen analysis
- Comparative botany analysis

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BIOME6000 Project

Aims of **BIOME6000 Project** :

- to summarize palynological data
  at MHO (6 ka years BP) and LGM (18 ka years BP) period;
- to compare current palynological patterns with the images
  at LGM an MHO periods

Vegetation classification has couple of steps:

- assignment of plant functional types (PFT);
- combination of characteristic PFTs determines different biomes

Steppe-tundra biome

- Problem: absence of steppe-tundra biome in modern environment and in BIOME6000 Project
- It may include features from steppe and tundra patterns
- DRYT biome used to be predominant in northern Eurasia in LGM
- It has a feature both of cold cryoxeric steppe (Yurtsev, 2001) and steppe-tundra (*Artemisia*, Cyperaceae and Caryophyllaceae)

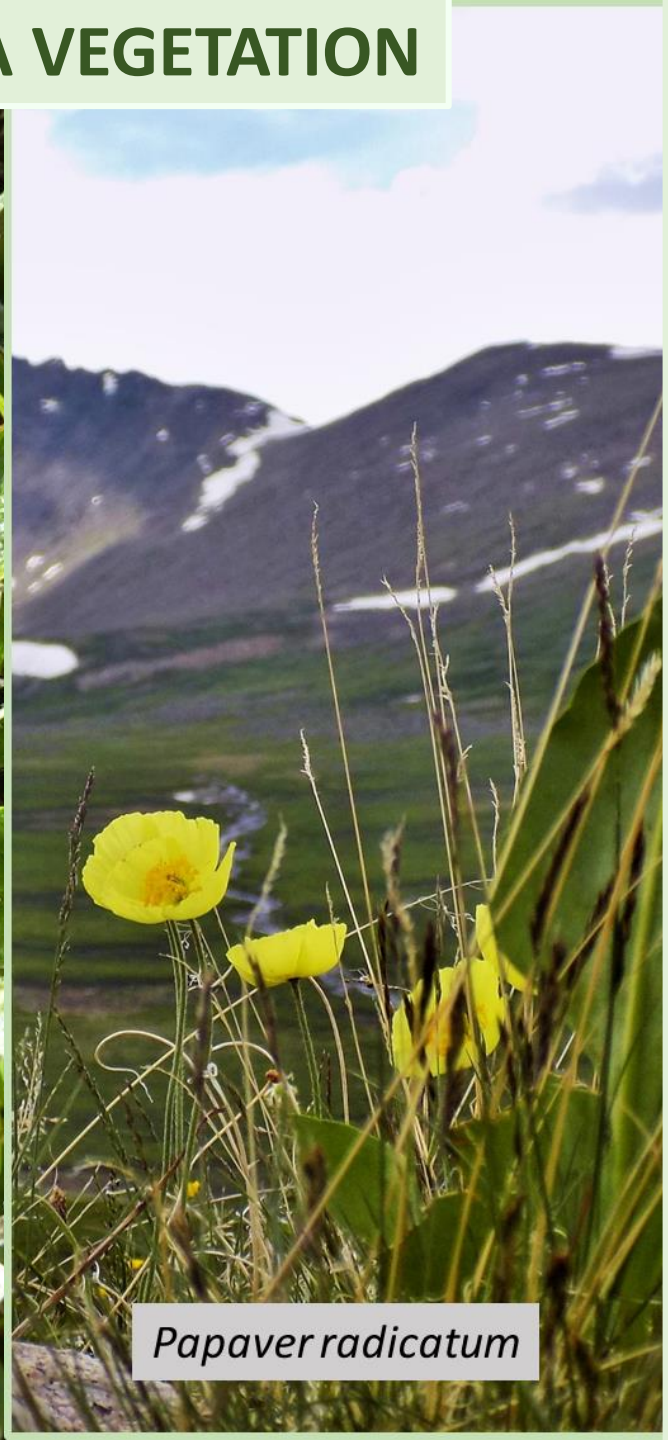
Table 1. ***Vegetation description of STEP, TUND and DRYT biomes from "BIOME 6000" Project (Bigelow et al., 2003; Kaplan et al., 2003)***

STEP	*Artemisia, Chrisotamnus, Hippophae, Kobresia, Purshia,* Brassicaceae, Chenopodiaceae
TUND	*Alnus fruticosa, Betula nana, Salix herbacea, Cassiope, Draba, Dryas, Empetrum, Eriophorum, Papaver, Pedicularis, Vaccinium,* Cyperaceae, Saxifragaceae, *Sphagnum* , lichens
DRYT	*Artemisia, Kobresia,* Brassicaceae, Asteraceae, Caryophyllaceae, Gramineae, true mosses

TUNDRA VEGETATION

Betula rotundifolia

Salix polaris

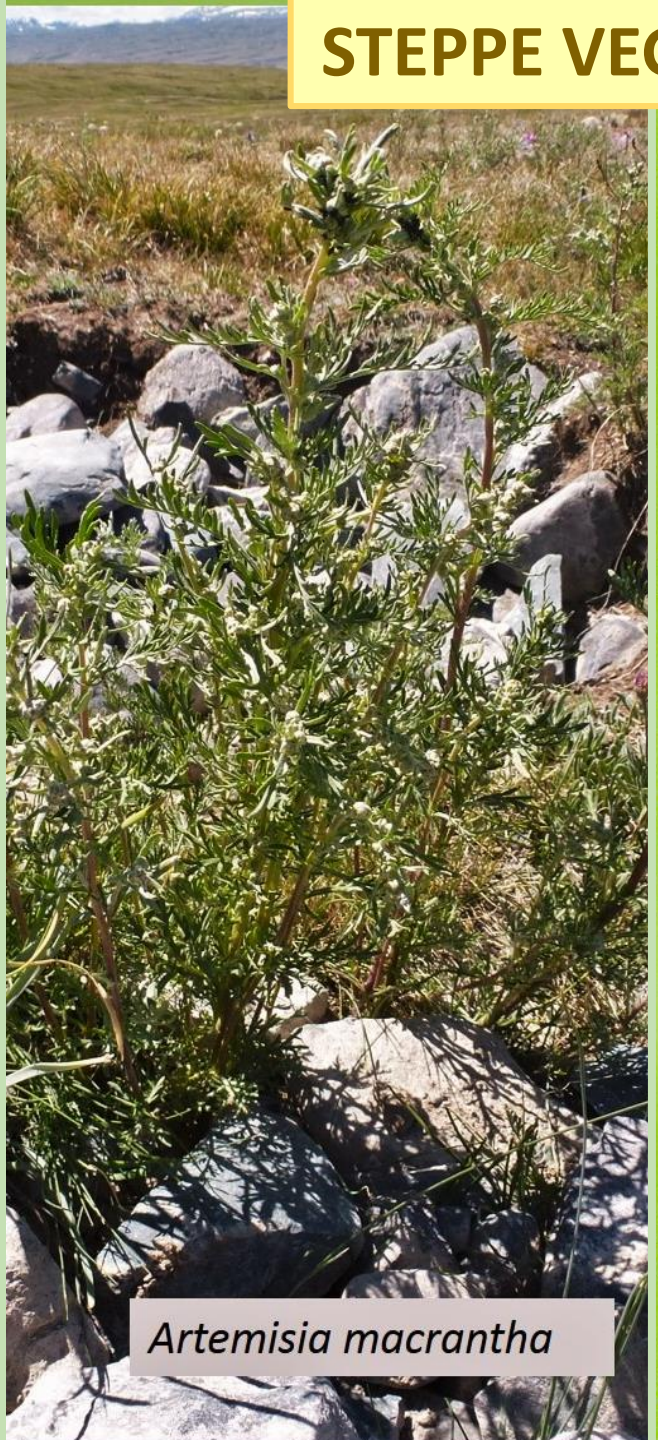


Papaver radicatum

Dryas oxyodonta

STEPPE VEGETATION


Kobresia smirnovii

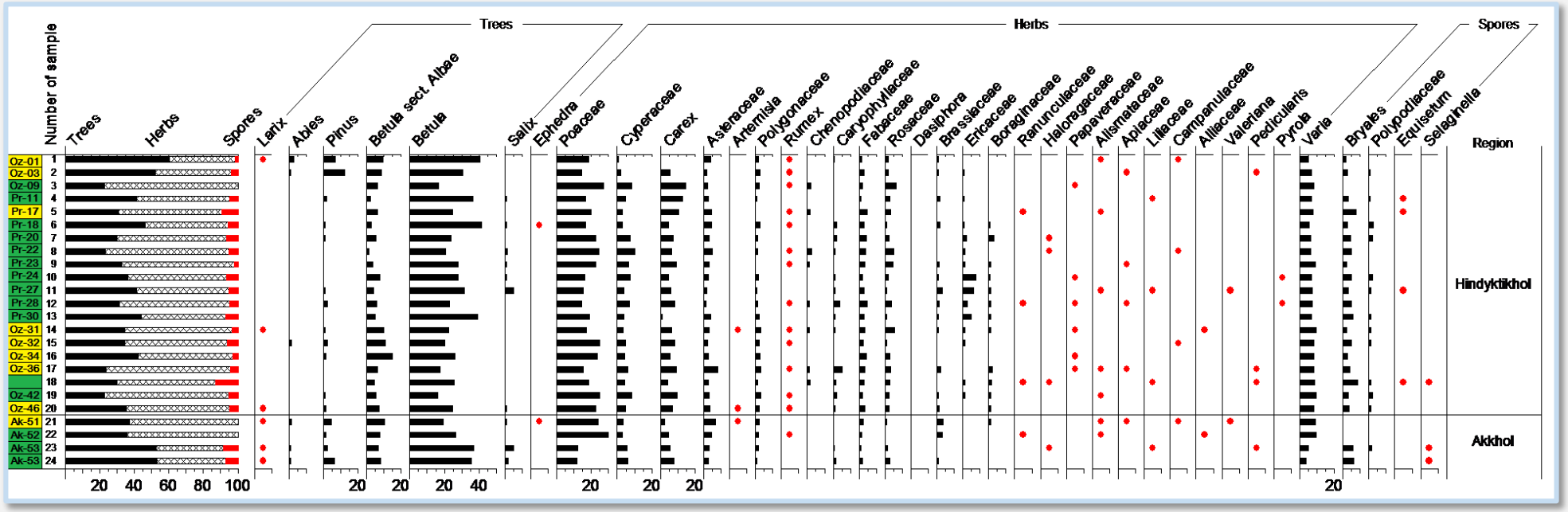

Artemisia macrantha


Potentilla spp.


Festuca spp.

Pollen spectra Khindiktig-Khol`and Ak-Khol` basins (2018)

- Trees vary from 36.4% to 45.5%
  - ✓*Betula nana* – 28.7% ✓*Betula sect. Albae* – 15.5% ✓*Pinus* – 12.7%
- Herbs reach up to 62.0%
  - ✓Poaceae – 30.2% ✓Carex – 14.6% ✓Cyperaceae – 10.4%
- Chenopodiaceae contains up to 5.3% at Khindiktig-Khol` region



Pollen spectra
Central Bertek (2018)

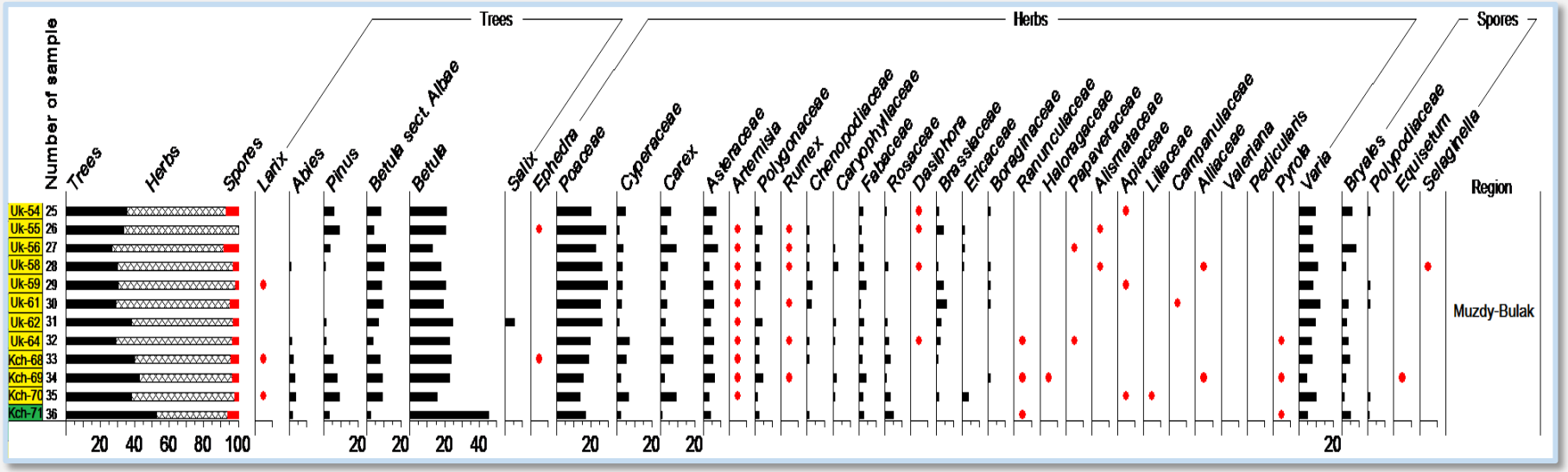
- Values of tree pollen – 36.4%

  ✓*Betula nana* – 23.0% ✓*Betula sect.Albae* – 10.8% ✓*Pinus* – 9.4%

- Herbs are predominant – almost 63.0%

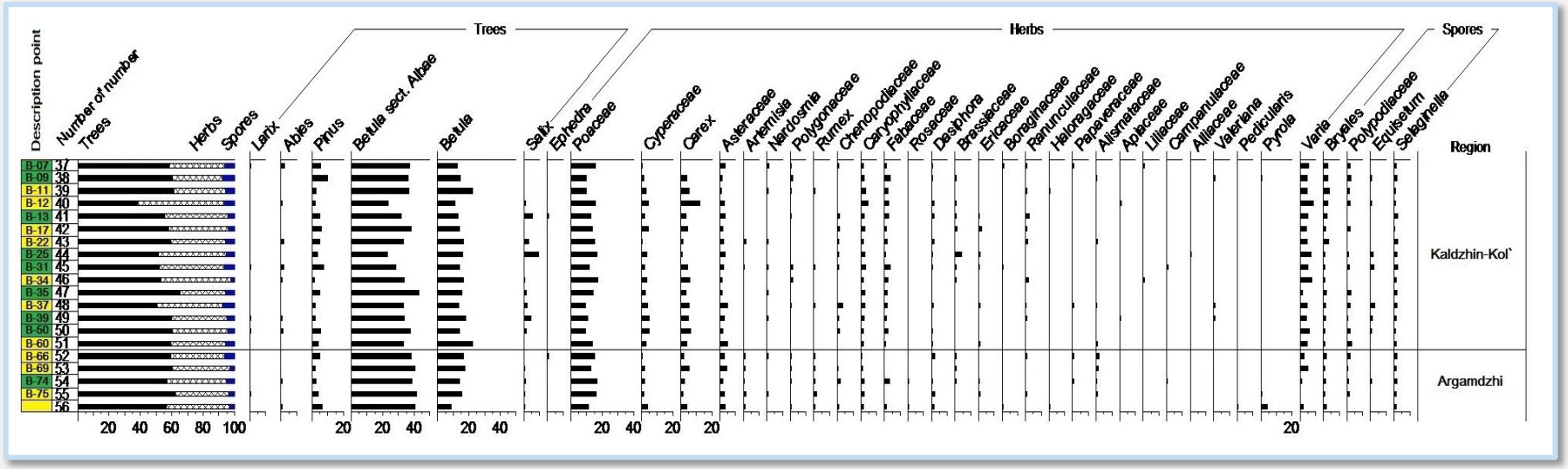
  ✓Poaceae – 30.0% ✓*Pyrola* – 12.0% ✓*Carex* – 9.6%
  ✓Asteraceae – 8.4% ✓Cyperaceae – 7.4%

- Almost all observed points at Muzdy-Bulak are considered to be steppe
- *Artemisia* (up to 3.6%) share is higher at Muzdy-Bulak



Pollen spectra: Western and Eastern Bertek (2019)

- Trees dominate (56.3%). Role of birch is prevalent (up to 43.2%)
- Herb consistence equals 38.1% in average
  ✓Poaceae – 17.2% ✓*Carex* – 12.1% ✓Cyperaceae – 5.1% ✓Asteraceae – 5%
- Trees are predominant – 59.3%
  ✓*Betula sect. Albae* – 41.5% ✓*Betula nana* – 17.3% ✓*Pinus* – 6%
- Herbs reach a value of 36.5%
  ✓Poaceae – 16.7% ✓*Carex* – 5.3% ✓Asteraceae – 4.7% ✓Cyperaceae – 4.2% ✓*Pyrola* – 4.2%



Artemisia and Chenopodiaceae role in pollen spectra

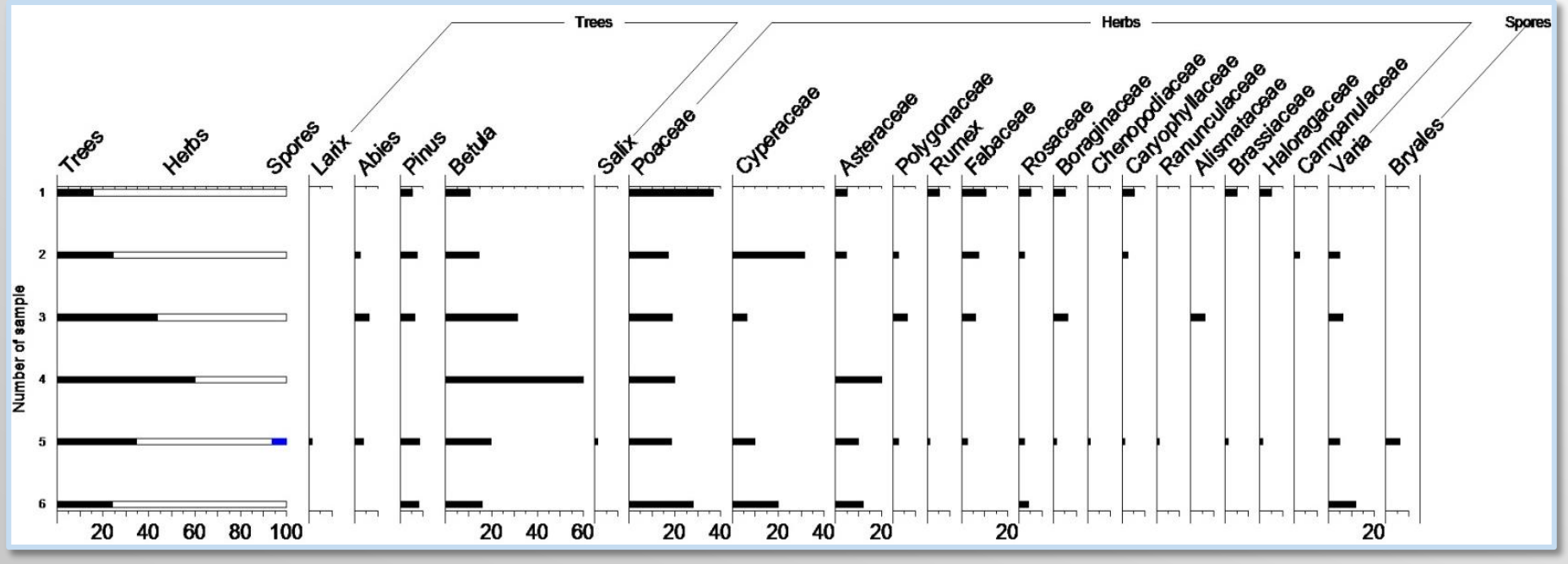
- *Artemisia* and Chenopodiaceae are the prime indicators of steppe conditions

- *Artemisia* prevails at the steppe sites of central and eastern part of Bertek depression

- Chenopodiaceae is mostly found within the coexistence of tundra and steppe cenosis in Khindiktig-Khol' area and western part of Bertek depression

Recent data from Khindiktig-Khol`and Central Bertek

- Recent samples are sensitive to weather conditions (precipitation and frost)
- Received data represent us diverse combination of tree and herb pollen:
  - ✓ predominance of *Betula* and *Pinus*
  - ✓ Poaceae, Asteraceae and Cyperaceae are abundant
- All tree pollen are transferable except dwarf birch and willow



Conclusions

- **Mixture of TUND and STEP biomes** is observed within Khindiktig-Khol` basin, western and eastern parts of Bertek depression; STEP biome is prevalent in the central part of Bertek depression
- **Typical pollen composition**: *Betula*, Poaceae, Cyperaceae, Asteraceae, *Artemisia*, Chenopodiaceae
- **Chenopodiaceae is a steppe indicator** of more humid areas (Khindiktik-Khol` basin and western part of Bertek depression)
- ***Artemisia* is the steppe indicator** of more arid areas and is found mostly on the bottom of Bertek depression (especially in the central part).
- **Results of palynological and paleoclimate studies showed that cold steppe and steppe-tundra are supposed to be analogs of Late-Pleistocene steppe-tundra in Northern Eurasia**

Please ask your questions!

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