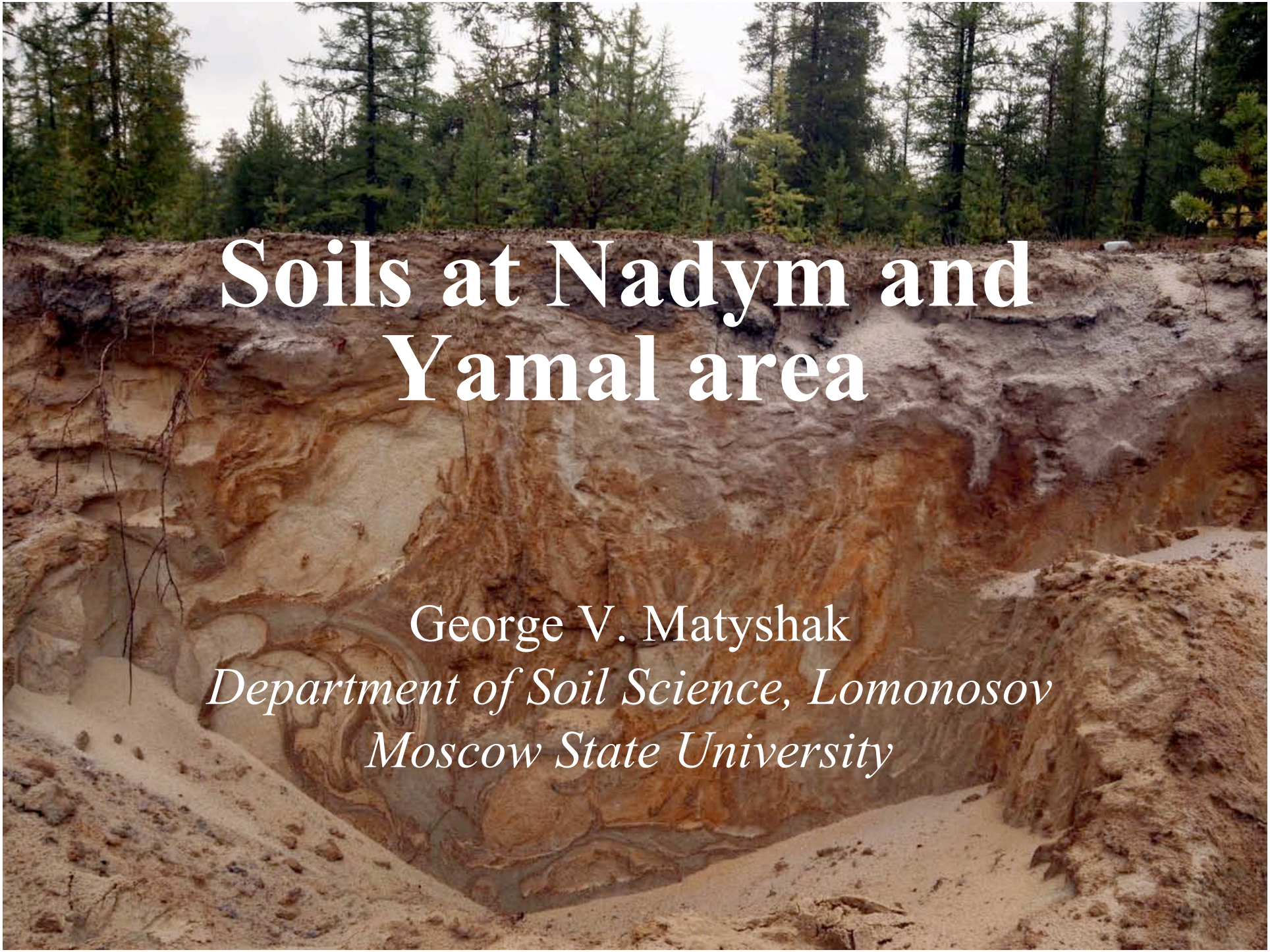

Soils at Nadym and Yamal area

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- Soils were examined at three research sites in the southern part of the Yamal Peninsula region:
  - Nadym (northern boreal forest)
  - Laborovaya (southern tundra) and
  - Vaskiny Dachi (typical tundra).
- Soil types vary greatly. From North to South, the main soil forming parameters are:
  - hydrothermal gradient
  - parent material
  - Vegetation
  - time of soil forming
- One of the most important factors is permafrost.

- Main soils at arctic sites:
  - histoturbels (peat gleyzems in Russia) and
  - haploturbels (cryozems in Russia)

- Main soils in northern boreal forest, in the absence of permafrost
  - haplocryods (podzols in Russia)

Soils at Nadym

Site without permafrost

Typic Haplocryods,
(Podzols in Russia)

Permafrost site

Typic Histoturbels,
(Peat Cryozems in Russia)

Soils at Laborovaya

Clay site

Typic Historthels,
(Peat Gleyzems in Russia)

Sandy site

Typic Haploturbels,
(Podburs in Russia)

Soils at Vaskiny Dachi

Clay site

Sandy site

Typic Histoturbels,
(Peat Gleyzems in Russia)

Typic Haploturbels,
(Podburs in Russia)

- General similarities of the studied soils
  - low-capacity organic profile (< 40 cm)
  - low contents of humus in mineral horizon
  - composed of moss and lichen in the different extent of conversion
  - signs of the eluvial leaching of R2O3 and humic materials
  - signs of the gley process
  - intense turbation
  - different-sized frost cracks, filled with decomposed organic material

Major processes of northern soil formation:

- Organic transformation
- Glayic processes
- Transfer and accumulation of R_2O_3 (Fe, Mn), humus and salts
- Chemical weathering of minerals (acid products of organic transformation)
- Physical (cryogenic) decomposition of mineral conditions

Organic transformation

Organic horizont of soil

- Oi; fibric material, loose, slightly decomposed lichen and moss
- Oe; brown (7,5YR4/4) hemic material, (H6, F3, R2, V0); very friable, moderately decomposed moss, common medium roots;
- Oa; dark brown (7,5YR3/3) sapric material (moss), (H8, F2, R2, V0); strongly decomposed very friable, common medium roots,

Mean chemical properties of the soil horizons found in Nadyms histoturbels

(Smallest N for any variable: 66)

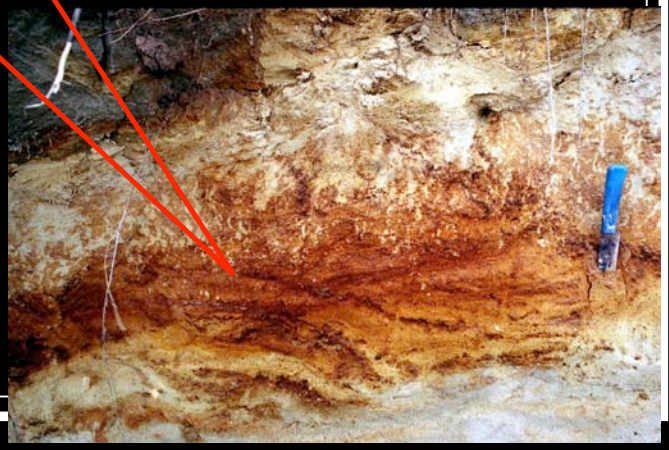
Horizon	H*	pH_{H2O} (1:2,5)	TC (%)	TN (%)
Lichen (*Cladina*)	0	4,1	42,1	0,4
Moss (*Sphagnum*, *Pleurozium*)	0	4,3	44,6	0,9
Oi	4	4,3	40,2	0,05
Oe	6	4,6	43,1	0,5
Oa	8	4,5	41,8	0,9
Bw		5,8	0,8	-

*H - The von Post scale of humification

Transfer and accumulation of R_2O_3 (Fe, Mn), salts

Salt in clay

Fe concentrations



The soil, formed on different parent material

Clay site

Sandy site

- At once, studied soils have differences, associated with influence of some specific factors like microrelief, availability and occurrence depth of permafrost, erosion processes (wind-formed, termo and other).
- These are such differences, as quantity and a degree decomposed organic horizon, pH mineral horizons, presence of salts, and also a degree of display of the main processes of soil

One of the most important factors, which strongly influences heterogeneity of soil properties is cryogenic action

Ice lenses

Cryogenic structure of mineral soil horizon

- The freeze-thaw cycle determines the formation of a microrelief and the microrelief has a considerable influence on soil properties.
- Soils in depressions (troughs) are more turbated; there are many frost cracks in them. The main feature is augmentation of organic material in deeper horizons as well as the extent of their conversion
- Soils beneath hummocks have an inverted picture

Влияние микрорельефа

Microhigh

Microlow

The freeze-thaw cycle determines frost crack formation

frozen cracks
Indicated by stripes
of black mucky peat

Cryoturbation

Organic turbation

Mineral turbation

Natural processes leading to soil destruction

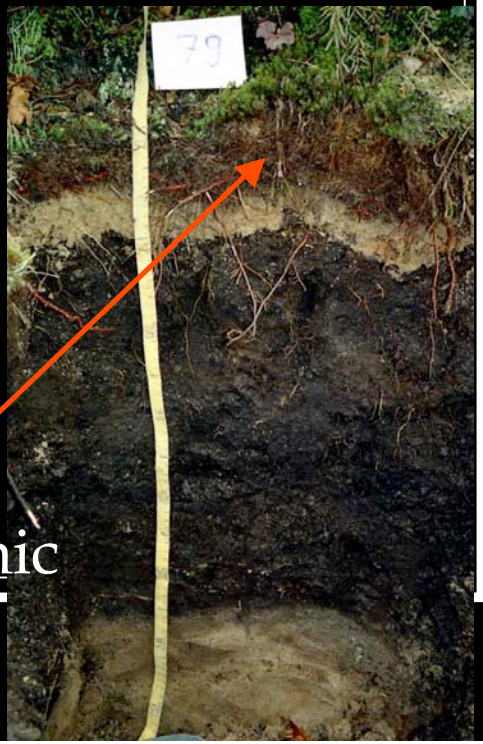
Wind erosion

Termoerosion

Technogenic disturbances leading to soil destruction

After 30 years

After 3 years



New organic horizont

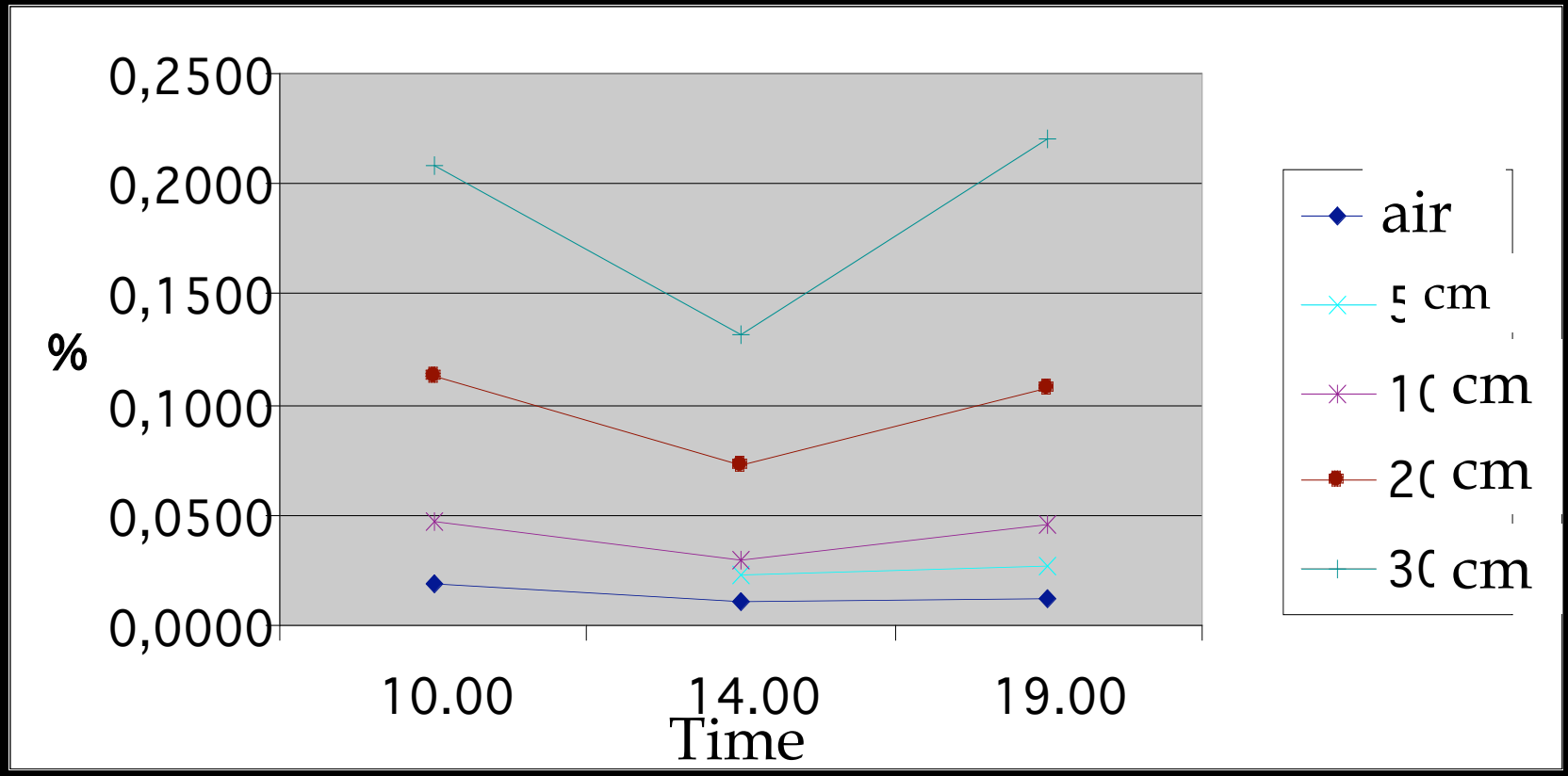
Gas (CH_4) emission from permafrost surface under disturbances (ppm)

	mineral permafrost			organic permafrost		
	Soil surface	Permafrost surface	Permafrost surface after 24 h	Soil surface	Permafrost surface	Permafrost surface after 24 h
Nadym	1,328	0,951	6,492	0,712	0,006	2,771
Laborovaya					0,0032	14,47
Vaskiny Dachi	0,015	0,00379	0,339/1,124 clay/sandy			

- Background gas emission from a soil surface was measured.
- Soil pits were dug and gas emission was measured from the active layer and permafrost surface. Measures were conducted immediately after soil opening and after 24 h.
- At all investigated plots, emission of CO_2 and CH_4 exceeding background emission at some orders of magnitude
- Thus any disturbances (natural or technogenic) which cause permafrost degradation have a considerable effect on gas emission.

CO_2 concentration in soil profile from a peatbog in Nadym

Usually concentration of CO_2 strongly increases downwards with the soil profile but also depends on the time of day (temperature).



Summary

- The studied soil share a number of common features but are differentially infleunced by climate, bedrock, plants, time.
- The permafrost regime has the greatest influence on physical and chemical properties of these soils.
  - The freeze-thaw cycle forms a distinct microrelief, frost cracks, cryoturbation, physical (cryogenic) decomposition of mineral conditions, and a platy soil structure. Therefore there is a strong intermixing of organic and mineral substances.
  - Permafrost detains substances, soluble in water, and determined some soil chemical processes.