Professional English

Lecture 5
Contamination monitoring of snow cover

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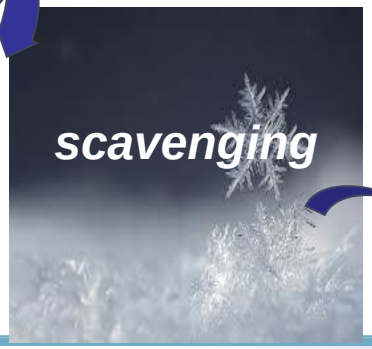
OUTLINE

1. Snow survey.
2. Snow sampling and preparation.

1. Snow survey

Snow is an efficient scavenger of aerosols



accumulation of aerosols particles in snow

In snow the information about pollutants is accumulated with two ways

With wet precipitation

With dry precipitation

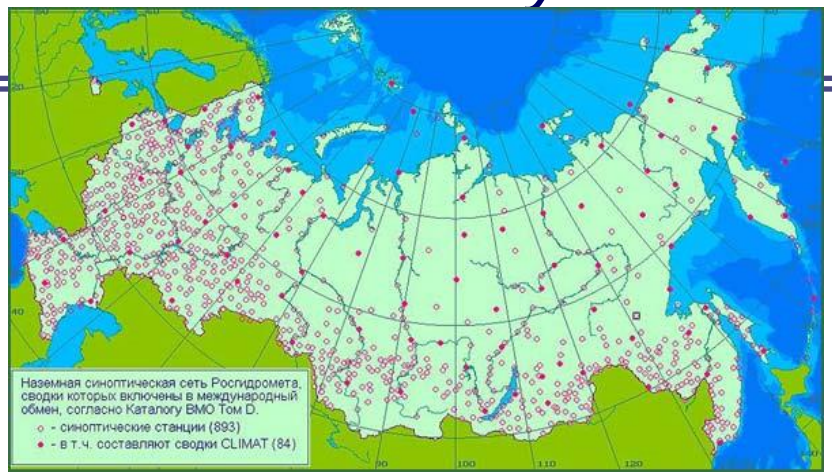
Лектор: Таловская А.В.

Works dealing with snow sampling and analysis of snow pollution by different substances are usually called *snowgeochemical investigations* or in brief – *snow survey*.

Atmogeochemical investigating method has been intended for study of background dust burden and peculiarities in substantial composition of regional dust-aerosol fall-outs

Networks of snow survey

Stationary



at Siberia territory the snow cover and aerosols composition are carried out with a help of snow survey more than in 500 observation points.

Temporal expeditionary

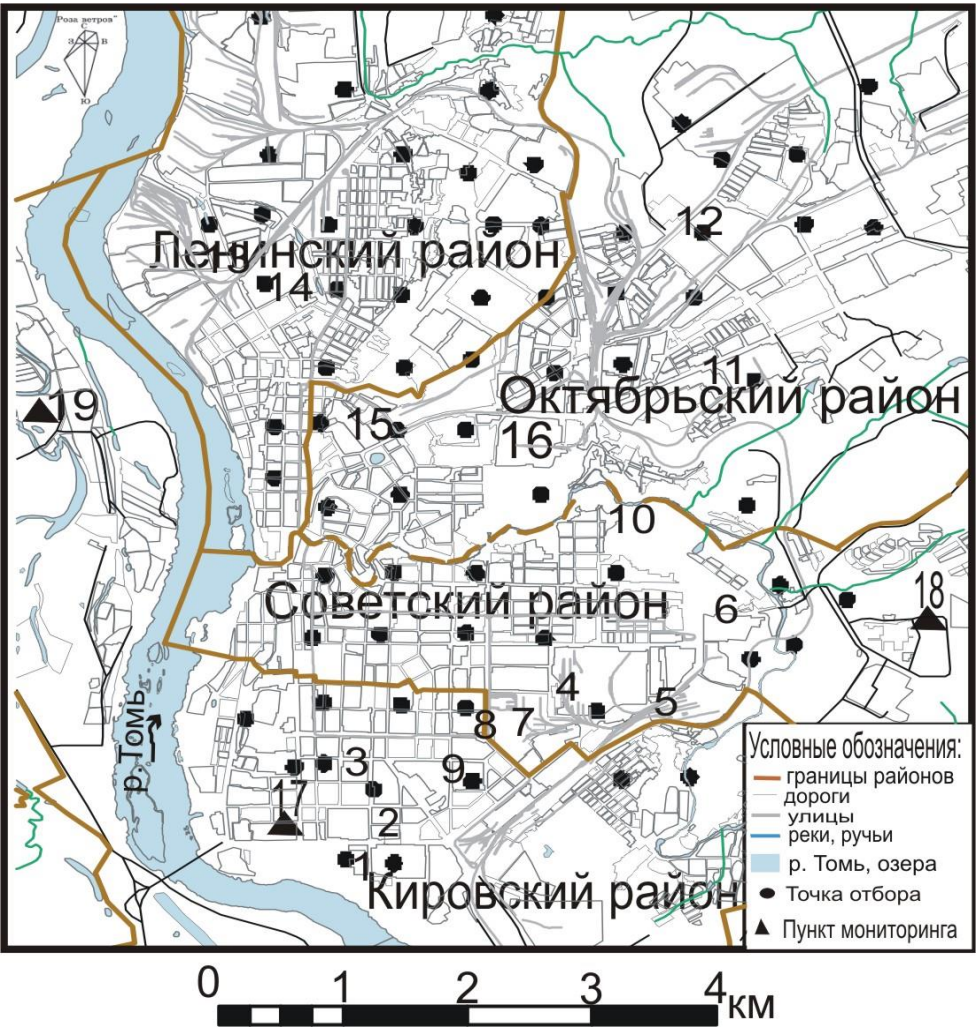
Environment component	Scale		
	city	enterprise territory	mining deposit territory
Snow	1:50 000	1:25 000	1: 5000

Take in account when make network

- ✓ Regulations, research guidelines
- ✓ Results of earlier ecological investigations
- ✓ Climatic conditions (e.g. wind rose)
- ✓ Landscape types, relief
- ✓ Sources location
- ✓ The main concept - to combine sampling sites with points of basic investigations.

(Язиков, 2006)

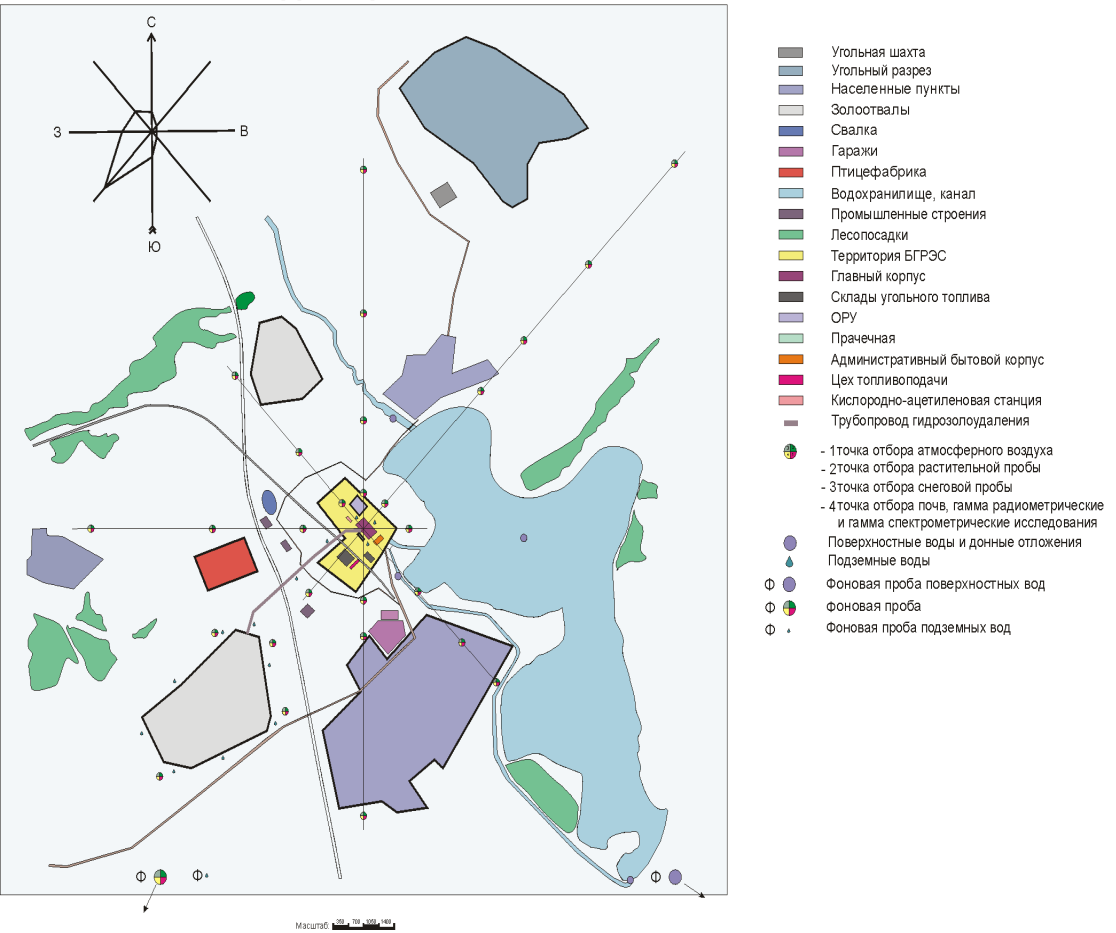
The sites of snowgeochemical expeditionary network



For snow survey in cities subject to assigned task approaching rectangular network the size of 1×1 km, 500×500 m or 250×250 m is used.

The sites of snowgeochemical expeditionary network

Проектный план геоэкологического мониторинга на территории Беловской ГРЭС



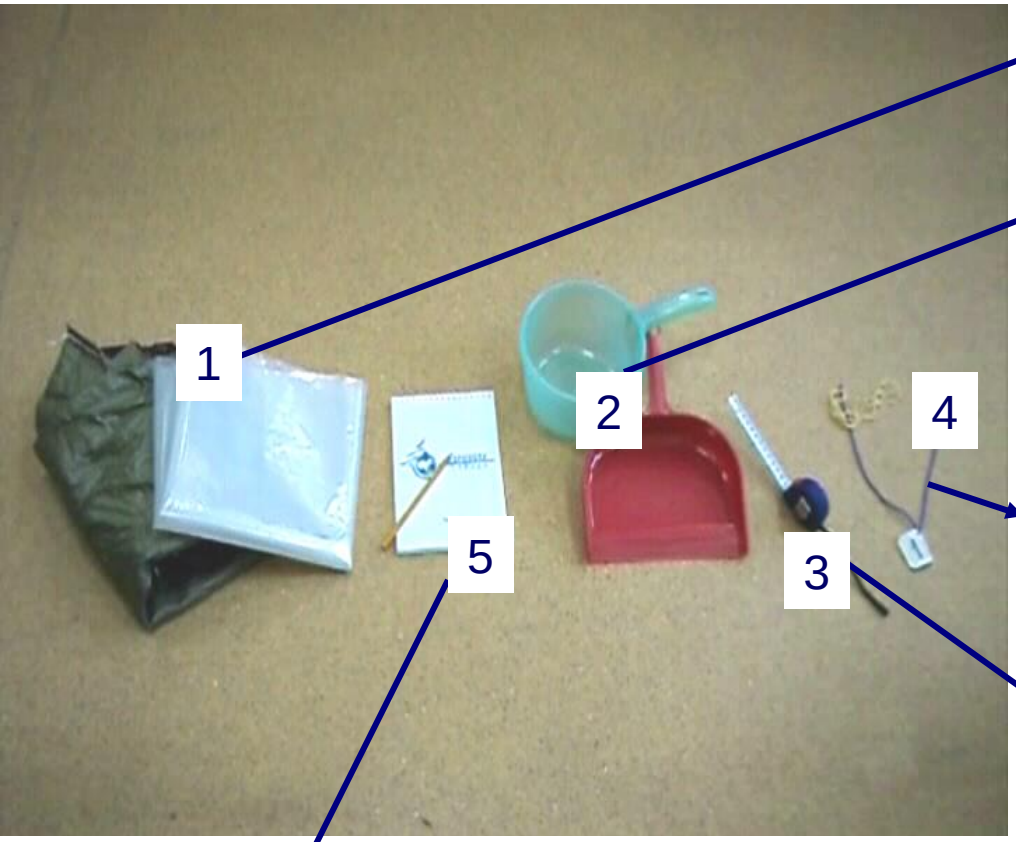
Scale of snowgeochemical surveying on industrial enterprise territory is 1:25000.

Sampling is carried out taking into account relief characteristics and their expositions relative the direction wind-dust transfer

In whole it is recommended to combine sampling places with points of basic investigations .

2. Snow sampling and preparation

What are needed for snow sampling?



plastic bag (30 l)

plastic scoop

string with label to show number of sample

ruler or tape measure

notebook, pan or pencil

Фото Филимоненко Е.А.

Snow sampling

snow sorter

V. Udachin

pit method

Snow sampling is carried out before the intensive period of snow melting (usually at the end of February or the beginning of March).

Snow sorter

It is a tube section 70 cm long with toothed bottom edge for slotting of thin crust of ice over snow, it has centimeter scale outside to measure snow cover height .

If snow cover height is 35 cm quantity of snow cores in sample is 6, and if snow cover height is 80 cm quantity of snow cores in sample is 4. Samples are placed in plastic bags and delivered in chemical laboratory.

Video task:
Explain the pit method in detail

Фото Филимоненко Е.А.

Pit method

Snow sampling is carried out by pit method for the whole thickness of snow cover, except for 5 cm layer over soil.

Фото А.Ю. Иванова

Then the pit sides and depths are measured. Sample weight is – 15-20 kg.

Sampling site, sampling date, sampling depth and sampling size are logged.

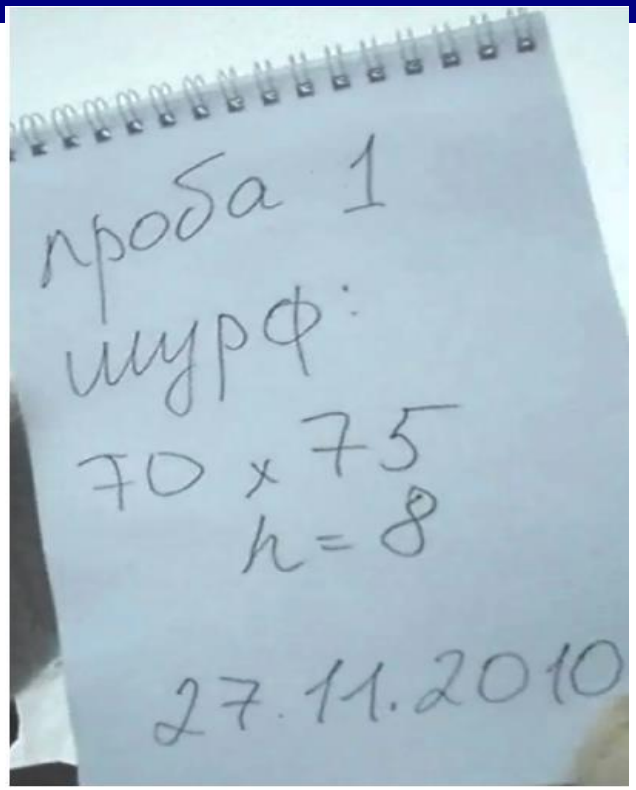


Фото Филимоненко Е.А.

Sample preparation

What are needed?

plastic basins and buckets

ashless paper filters black blue ribbon type

1-2 liter glass pots

a funnel, tweezers

a plastic tubule 4-5 mm in diameter to pour off water , a spray bulb

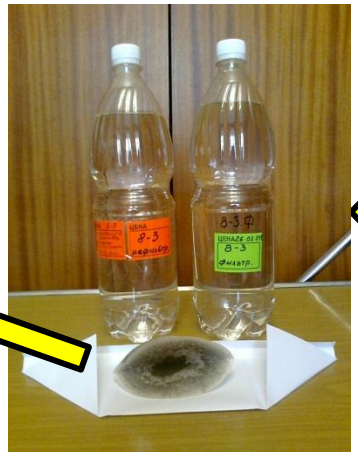
Task: Describe show samples preparation

Snow sampling (pit method)

Snow samples (15-20 kg)

Melting (18-22^{0}C)

Filtering



Drying the filter

Sifting

Weighting

The scheme of processing and analysis of snow samples

Фото: Таловской А.В., Филимоненко Е.А.

Melting at room temperature

1. Samples

2. sign sample number on the container

3. pour out from the bag into clean plastic basins and buckets

We need a day snow melts at room temperature

4. cover with plastic bag

filtration and drying processing

1. Remove big extraneous substances from water with a help of tweezers

2. Snow water pours off through the plastic tubule 4-5 mm in diameter (it shouldn't touch walls and bottom of the container) in other container.

3. Leave 1-1.5 l "dirty" water in all plastic basins and buckets. Rinse them with this water 2-3 times)

4. It is necessary to pour off 1-1,5 liters "dirty" water in bottles

filtration and drying processing

5. There is 1-1,5 liter dirty water left over.

6. Weighing “clean” ashless filters

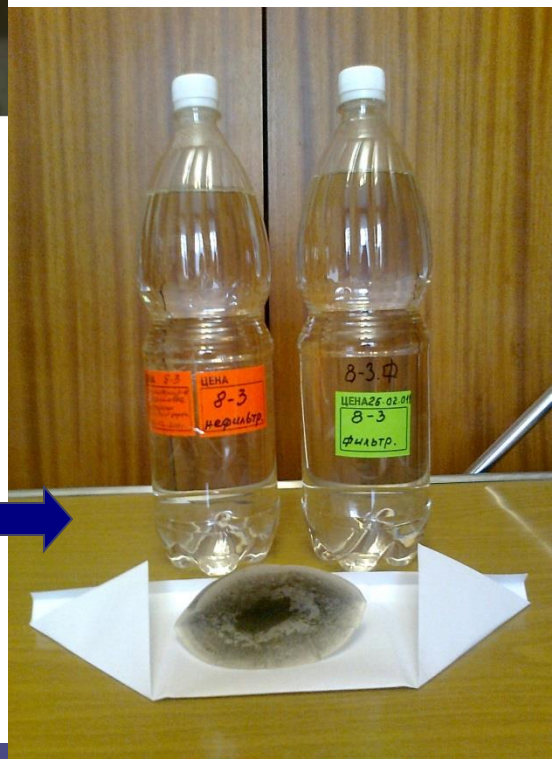
7. Pass dirty snow water through ashless filter = water is filtered

8. Drying is made at the room temperature

sifting and weighing processing

1. Dried samples are dressed through the bolt with the size of mesh 1 mm to remove the impurities

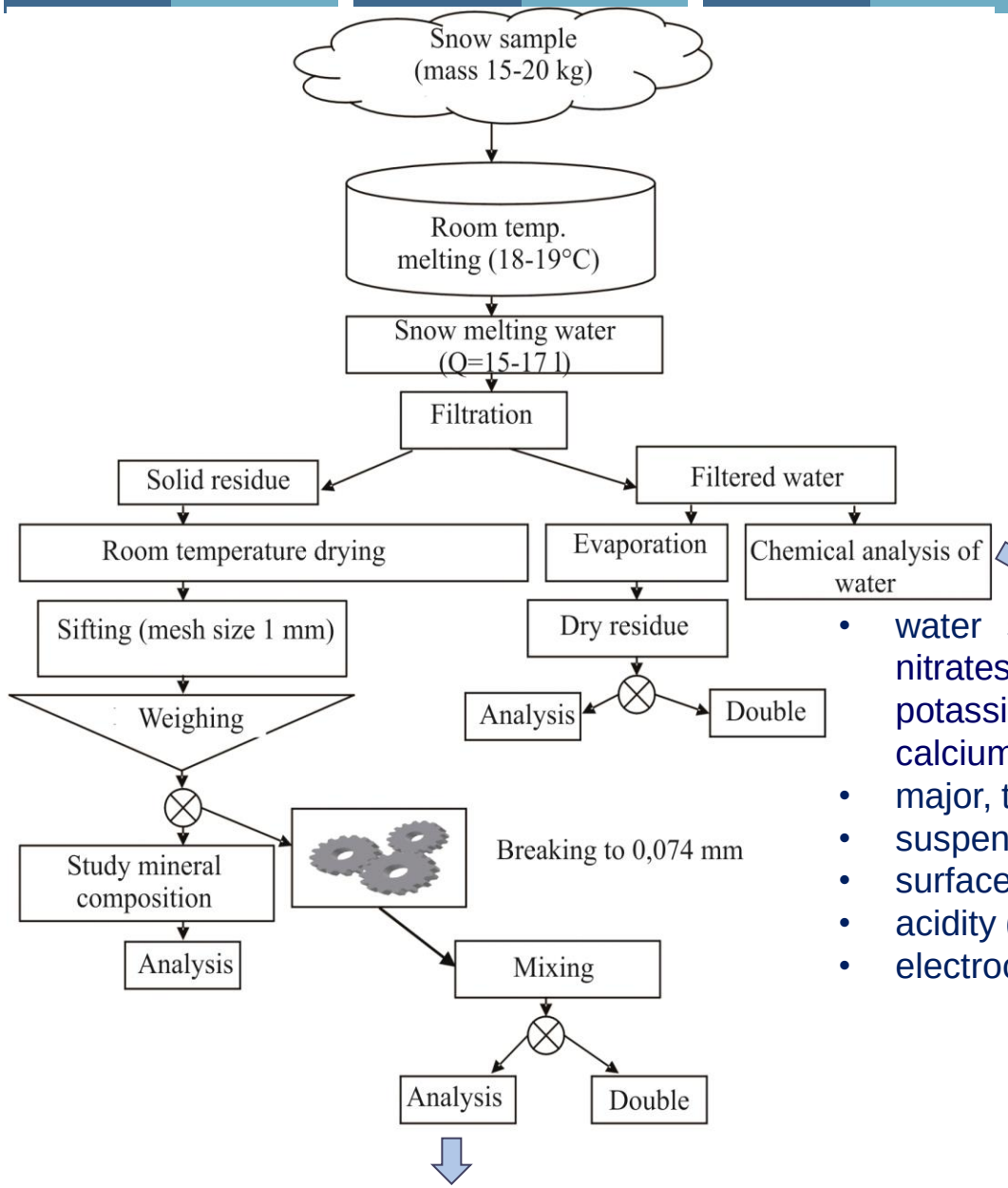
2. Samples are weighed. The difference in the filter mass before and after filtration shows the dust mass in samples.



Total: 1-2 l filtered and unfiltered water, filter with snow solid residue are sent for analysis.

Лектор: Таловская А.В.

The scheme of processing and analysis the snow samples



- water soluble compounds (sulphates, nitrates, ammonium, chlorides, potassium, sodium, magnesium, calcium),
- major, trace elements,
- suspended substances,
- surface active agents
- acidity (*pH*)
- electroconductivity

Major, trace elements, minerals

Aim is to reveal

source origin, polluted areas,
marker elements and minerals for industrial emissions

insoluble fraction of aerosols in snow

snow melt water

- Dust load
- Element concentrations
- Elements fallout from air on snow
- Modes of element occurrence
- Mineral and anthropogenic particles

Research methods of snow in the laboratories of our Department

1. Elemental composition

- *neutron activation analysis*

(U, Th; As, Cr, Ba, Sr, Co, Zn, Sb; Hf, Sc, Cs, Rb, Ta; Eu, Sm, Lu, Yb, La, Ce, Tb, Nd; Au, Ag; Br, Ca, Na, Fe)

- *electrometric method (F)*
- *atomic absorption spectrometry (Hg)*

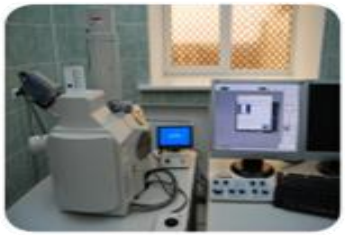

2. Mineral composition

- *Scanning electron microscopy*
- *Binocular microscope*
- *X-ray diffraction analysis*



3. Occurrence mode of elements

- *Scanning electron microscopy*
- *f-radiography method*




4. Biotesting

- *Mutagenic effect for Drosophila*


Method for definition of snow cover pollution with anthropogenic aerosol particles


РОССИЙСКАЯ ФЕДЕРАЦИЯ

ПАТЕНТ

НА ИЗОБРЕТЕНИЕ

№ 2229737

СПОСОБ ОПРЕДЕЛЕНИЯ ЗАГРЯЗНЕННОСТИ СНЕГОВОГО ПОКРОВА ТЕХНОГЕННЫМИ КОМПОНЕНТАМИ

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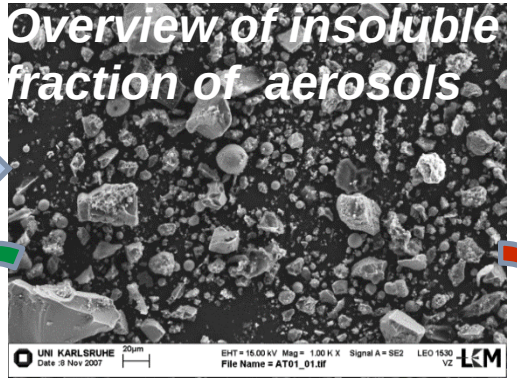
Руководитель Федеральной службы по интеллектуальной собственности, патентам и товарным знакам

Б.П. Симонов

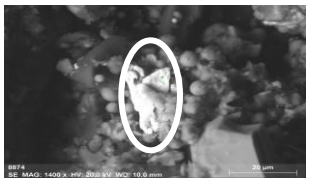
patent RF № 2229737

Electron scanning microscopy



Overview of insoluble fraction of aerosols

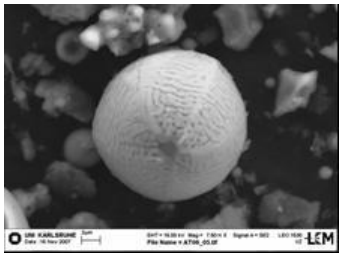
Mineral components



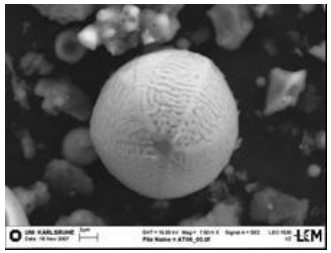
barite

calcite, quartz, amphibole, albite, biotite, feldspar, pyrite, stibnite etc.

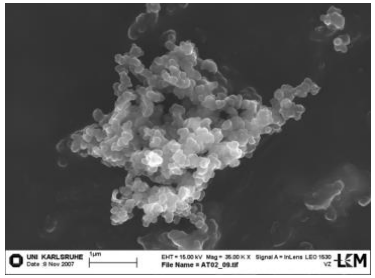
Anthrogenic components



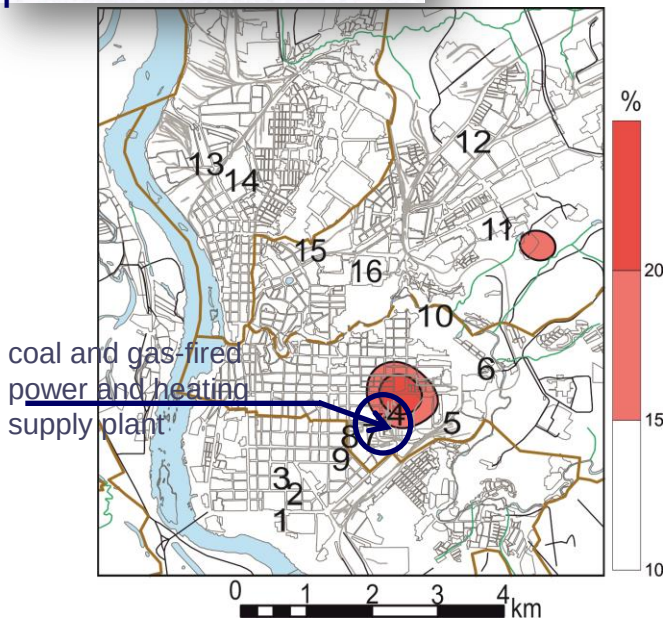
Al-Si spherules



Spherules with Fe-oxides



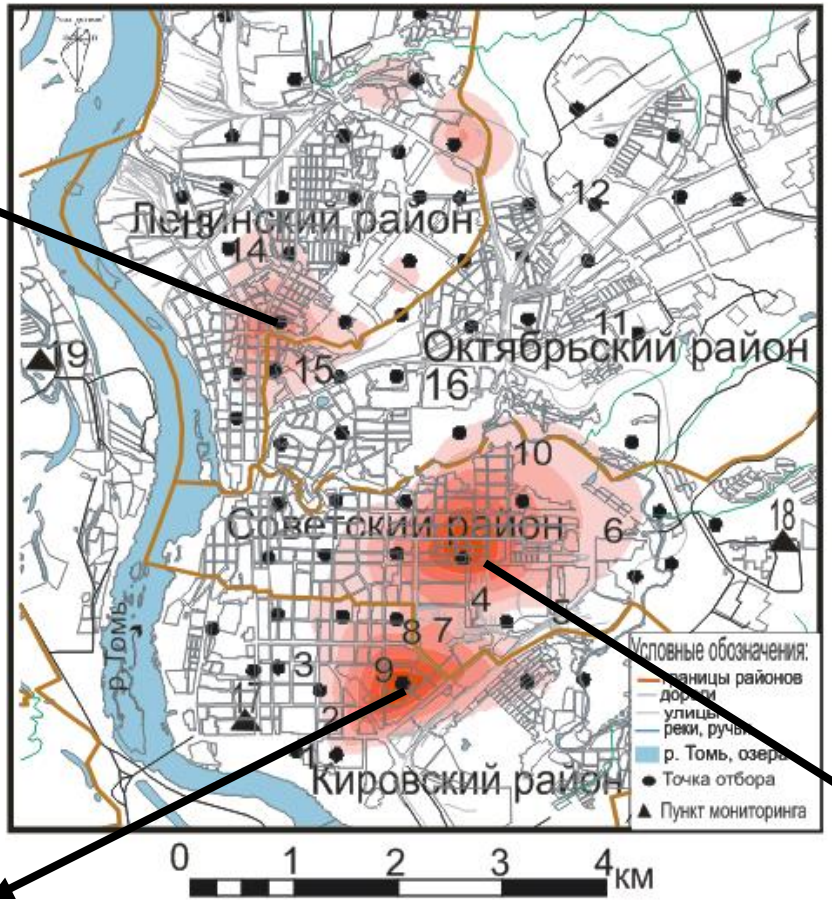
Soot



Distribution scheme of Al-Si spherules in insoluble fraction of aerosols in Tomsk

Hg concentration in solid particles recovered from snow of Tomsk city, according to data atomic absorption method

boiler house



engineering industry

power station

Background value 0.08 мг/кг, п. Киреевск

Conclusion

The composition study of solid aerosol particles recovered from snow by help of modern analyses makes it possible to:

- reveal mineral, organic and anthropogenic particles,
- identify the peculiarity of dust industrial emissions,
- determine origin of atmospheric particles,
- make environmental assessment.