Professional English

Lecture 6
Mineral and anthropogenic particles in aerosols. Part 1

Anna V. Talovskaya

Associate professor

Candidate of geological and mineralogical science

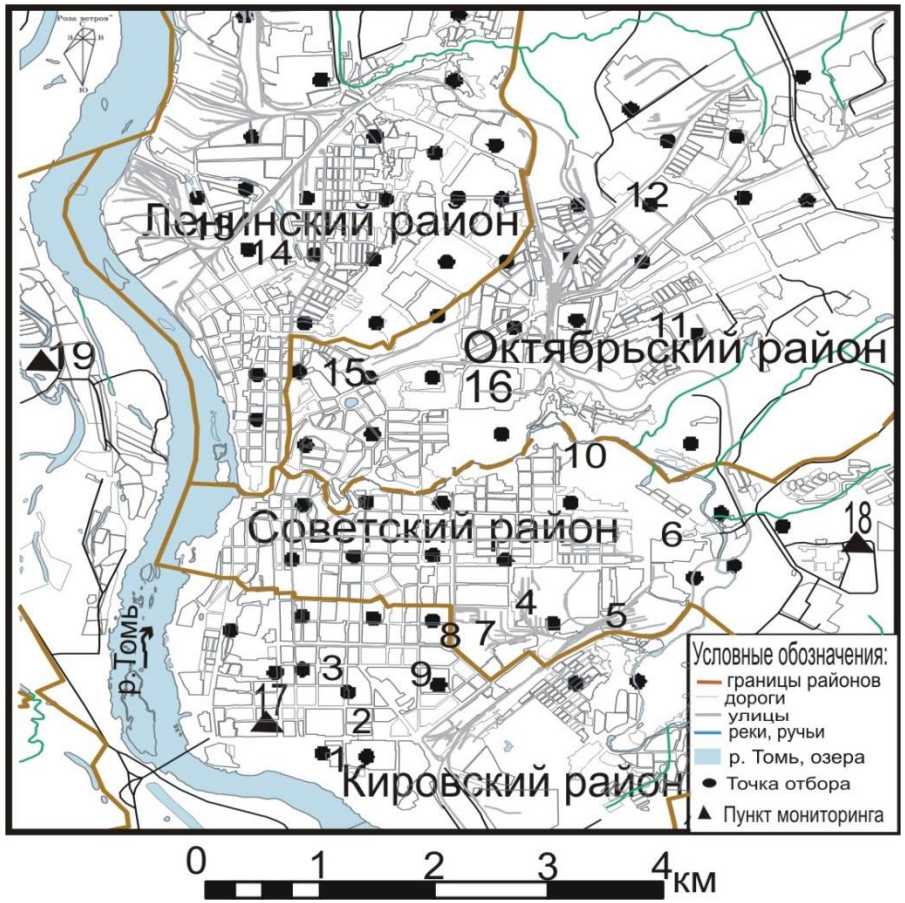
Institute of natural recourses
Department of Geoecology and Geochemistry

Outline

1. Studying methods.
2. Dust load.
3. Mineral and anthropogenic particles in solid particles of aerosols.

1. Studying methods

Map of sampling sites in Tomsk city



1-16: some enterprises
1, 5, 11, 12 - construction industries;
2, 6, 7, 8, 9, 16 - different engineering plants;
3 - electric bulb factory,
4 - heat-power plant,
10 - ash disposal area,
13- sleeper impregnation factory,
14 - plant of rubber footwear

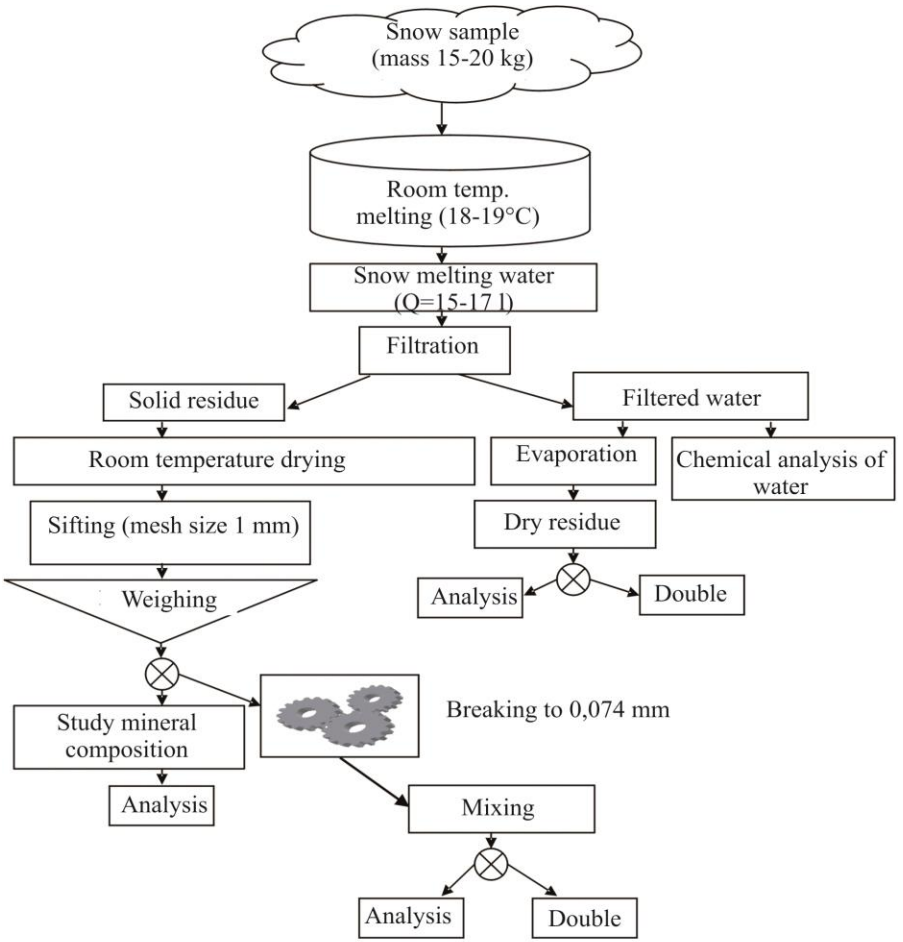
1-16 - plants
17-19 – monitoring points: 17 – campus TPU,
18 – Academgorodok, 19 – Timiryazevo.

The scheme of processing and analysis of the snow samples

After sampling the snow is melted, snow water is filtrated to get the solid residue of snow and filtrate.

The solid residue of snow is dried and weighted.

The object of our investigation is ***snow solid residue*** or ***insoluble fraction of aerosols in snow***.



Laboratories

- Institute of Mineralogy and Geochemistry (University of Karlsruhe, Karlsruhe, Germany)
- Innovation Scientific-Education Centre “Uranium Geology” (TPU, Department of geoecology and geochemistry)
- Кафедра световой и лазерной техники

Innovation Scientific-Education Centre “Uranium Geology” (TPU, Department of geoecology and geochemistry)

laboratories:

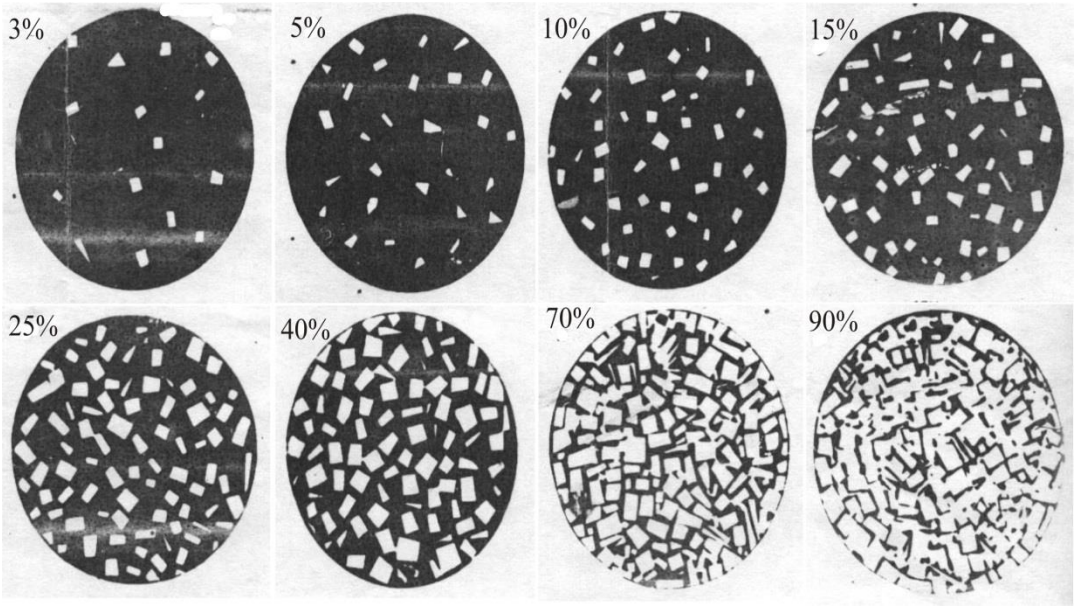
- Nuclear-geochemical laboratory
- Electron-optic laboratory
- Isotope spectrometry laboratory
- Microelement Analysis Laboratory
- Geotechnology

Schlich analysis

on Binocular microscope (Leica EZ4D)

Characteristics of the particles

1. Color.
2. Lustre.
3. Hardness.
4. Transparency.
5. Shape and size.
6. Character of surface.
7. Level of oxidation.



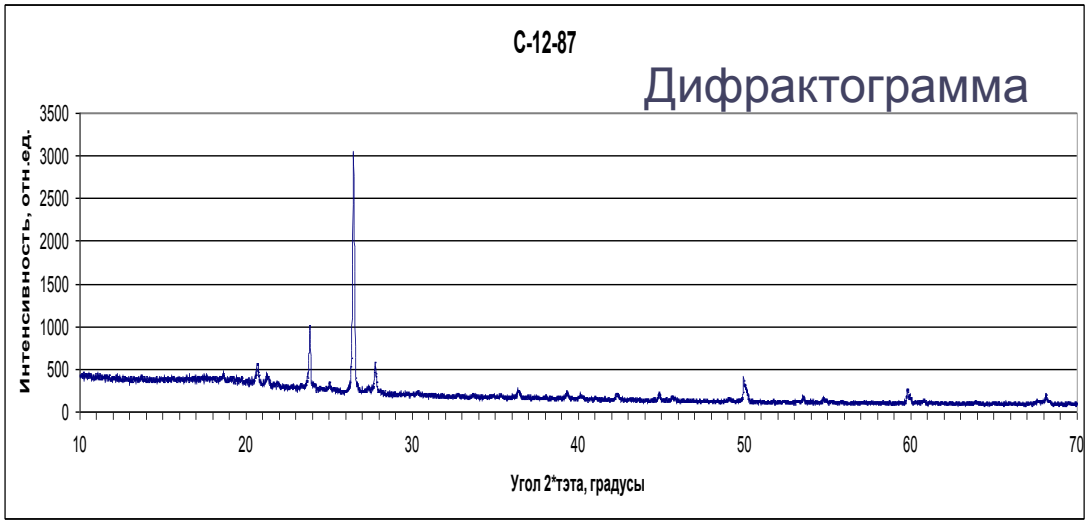
Comparative method of determination content of mineral and anthropogenic particles in samples. Total content – 100 %

Scanning Electron Microscope

"LEO 1530 Gemini“ (Working distance 5 mm), **University of Karlsruhe**

Hitachi S-3400N with X-ray spectral microanalyser – Bruker (Working distance 3 nm), TPU

X – ray diffraction analyses



Это анализ структуры вещества, с помощью рентгеновских лучей. Достоинством метода является низкая погрешность сходимости (1-3%), малая зависимость результатов от матричного эффекта (от изначальной пробы), низкий предел обнаружения – 10-4%.

Quartz cuvette with samples inside

2. Dust load

Dust load

quantity of solid particles which are faulted in a unit of time on unit of square:

$$Pn=Po/(S*t),$$

Pn - dust load , mg/m^2 * day (kg/km^2*day)

Po – weight of the snow solid residue, mg (kg);

S – square of the pit, m^2 (km^2);

t – number of days from snow-up day (the day when snow fault and does not melt) to sampling day , day.

Геохимия окружающей среды , 1990

There is the following gradation for values of dust burden in terms of the recommendations:

less than 250 mg/m^2 per day – safety morbidity level;

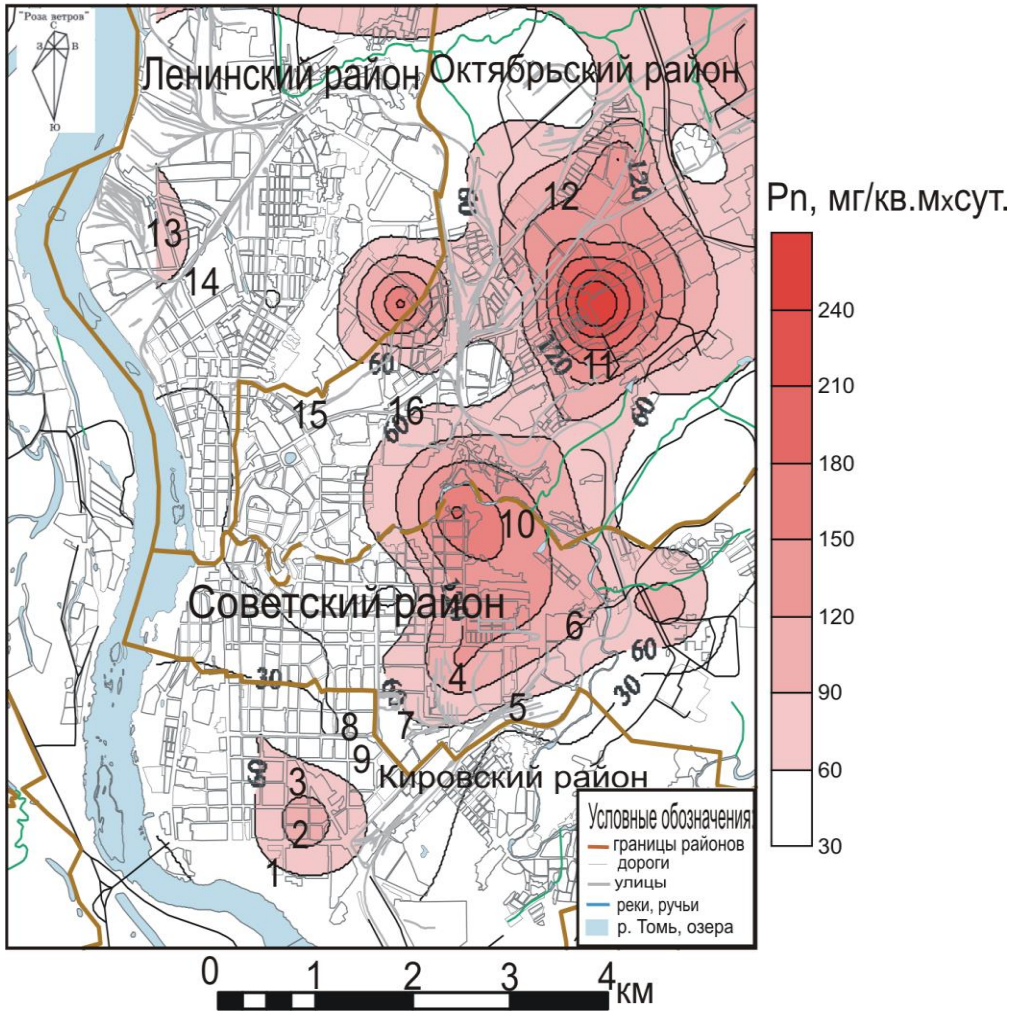
250-450 mg/m^2 per day – mildly unsafe one; increase in bronchial asthma and conjunctivitis;

450-850 mg/m^2 per day – unsafe one; increase in respiratory and sense organs morbidity;

more than 850 mg/m^2 per day – immensely unsafe one; increase in morbidity more than 2 times.

Геохимия окружающей среды , 1990

The scheme of distribution of dust burden within Tomsk-city

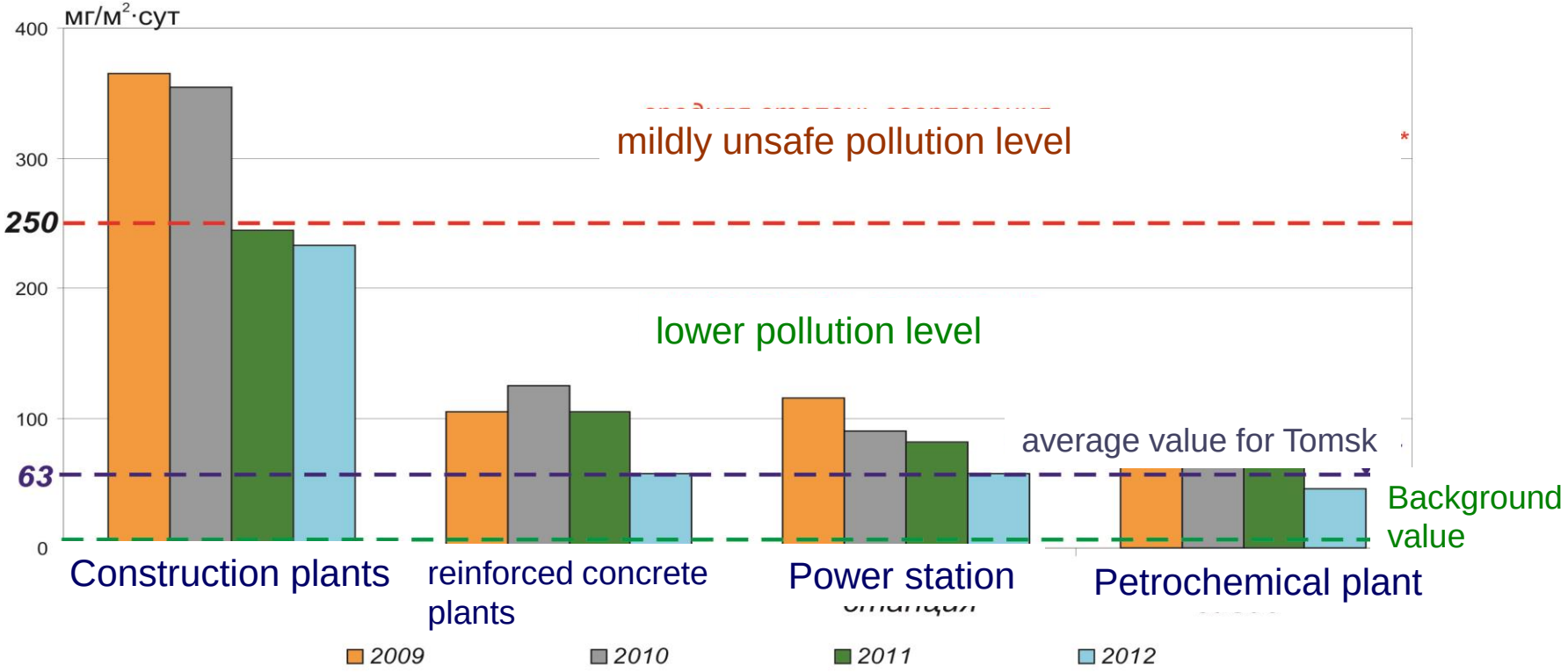


According to the results of the observation the dust burden rages from 16 mg/m^2*day (river-boat station) to 303 mg/m^2*day (Suvorova st.).

It is up to 43 times more than the background value. The most polluted areas are Octyabrskii district and the effected zone of the power station “GRES-2”.

Pn – dust burden. Background value is 7 mg/m^2*day (Шатилов, 2001).

Dust load in impact zones of some plants in Tomsk city

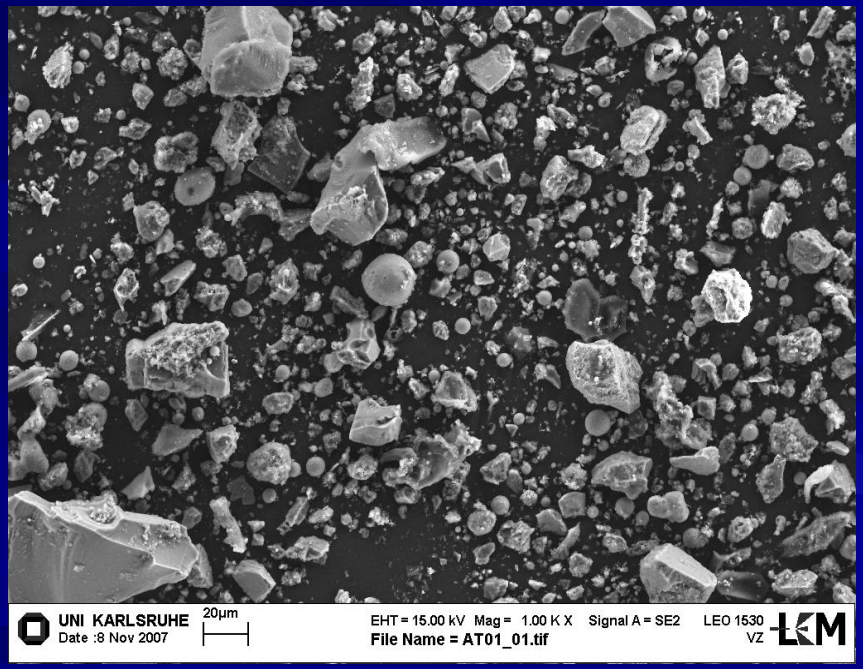


*- градация уровней пылевого загрязнения, («Геохимия…», 1990)

** - данные А.В. Таловской, 2007 г.

Фон (**7 мг/м2*сут)** по данным А.Ю.Шатилова (Средний Васюган, 2001)

3. Mineral and anthropogenic particles in solid particles of aerosols



РОССИЙСКАЯ ФЕДЕРАЦИЯ

ПАТЕНТ

НА ИЗОБРЕТЕНИЕ

№ 2229737

СПОСОБ ОПРЕДЕЛЕНИЯ ЗАГРЯЗНЕННОСТИ СНЕГОВОГО ПОКРОВА ТЕХНОГЕННЫМИ КОМПОНЕНТАМИ

Патентообладатель(ли): *Томский политехнический университет (RU)*

Автор(ы): *Язиков Егор Григорьевич (RU),*
Шатилов Алексей Юрьевич (RU),
Таловская Анна Валерьевна (RU)

Заявка № 2002127851
Приоритет изобретения 17 октября 2002 г.
Зарегистрировано в Государственном реестре изобретений Российской Федерации 27 мая 2004 г.
Срок действия патента истекает 17 октября 2022 г.

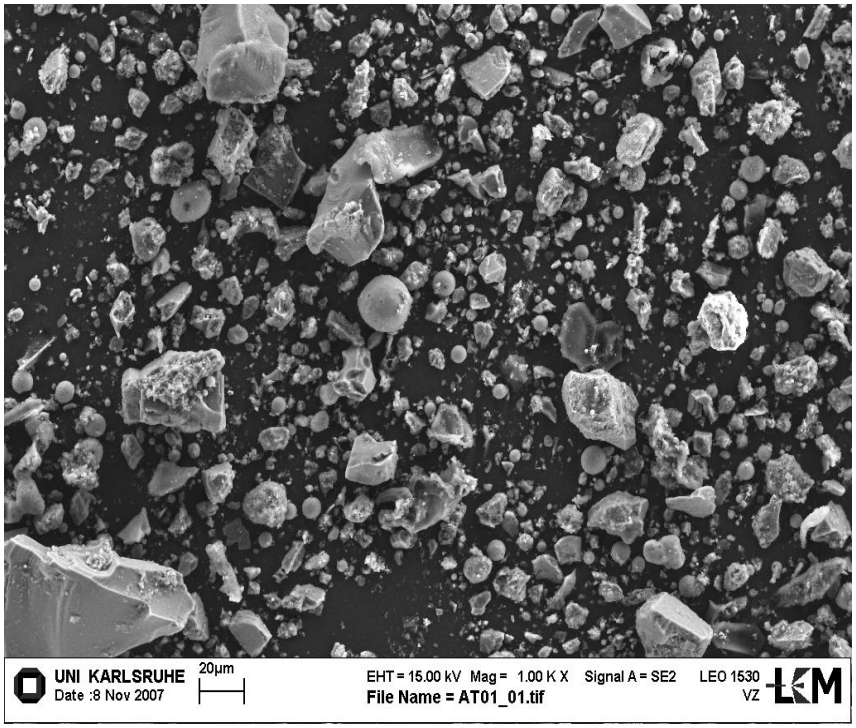
Руководитель Федеральной службы по интеллектуальной собственности, патентам и товарным знакам

Б.П. Симонов

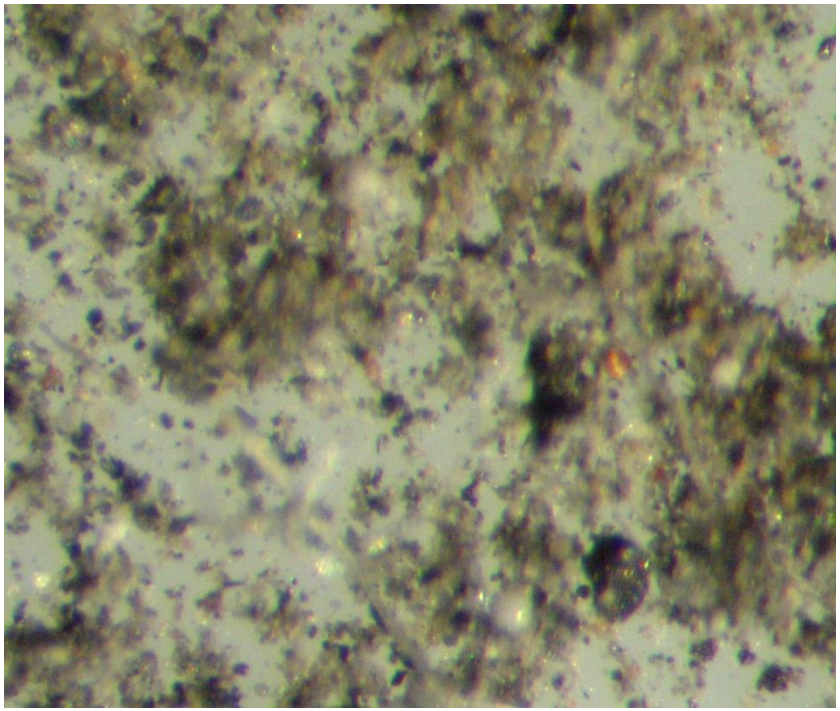
The investigation of the mineral composition of the solid residue of snow is carried out according to the patent № 2229737 (Russian Federation).

“Method for definition of snow cover pollution with anthropogenic components”. Tomsk Polytechnic university; Authors: E.G Yazikov., A.Yu. Shatilov, A.V. Talovskaya – application № 2002127851 from 17.10. 2002 (in Russian).

General view of the snow solid residue



according to the data of the electron microscopy



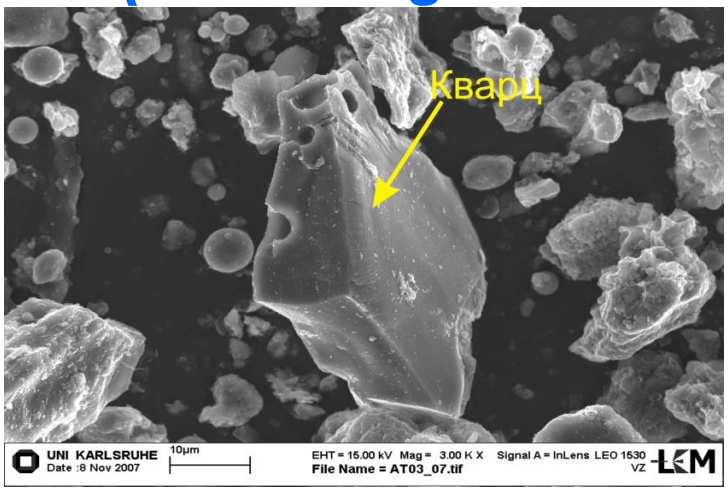
according to the data of the binocular microscopy

Mineral components

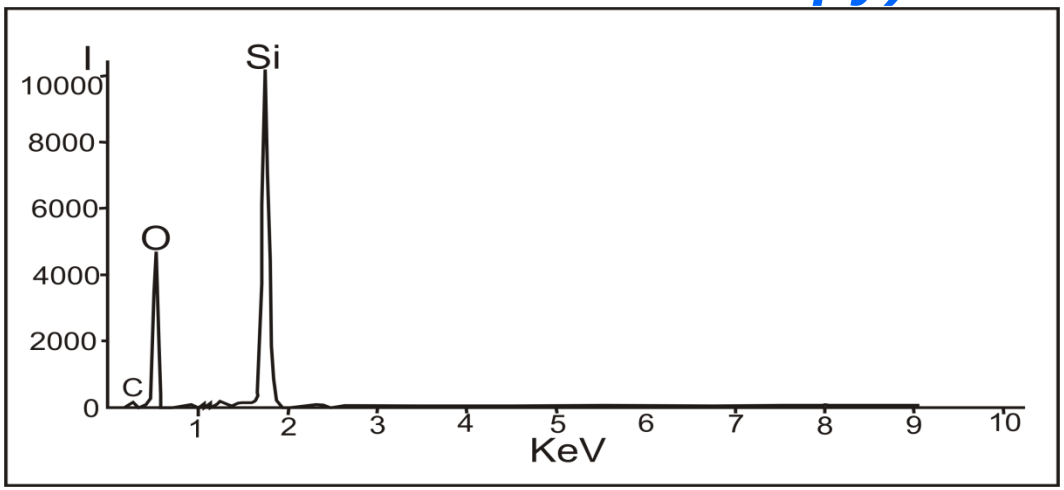
The sources:

- erosion of the rivers' banks,
- construction industry emissions
- power stations, boiler plant emissions
- ice-slick protection
- diffuse pollution (e.g. from Middle Asia)

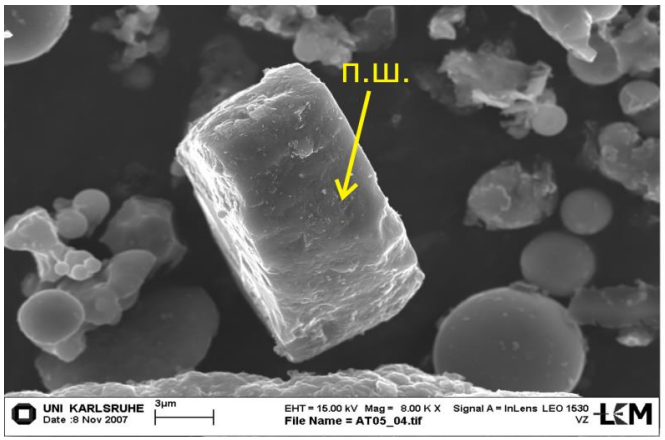
Mineral components
(according to the data of the electron microscopy)



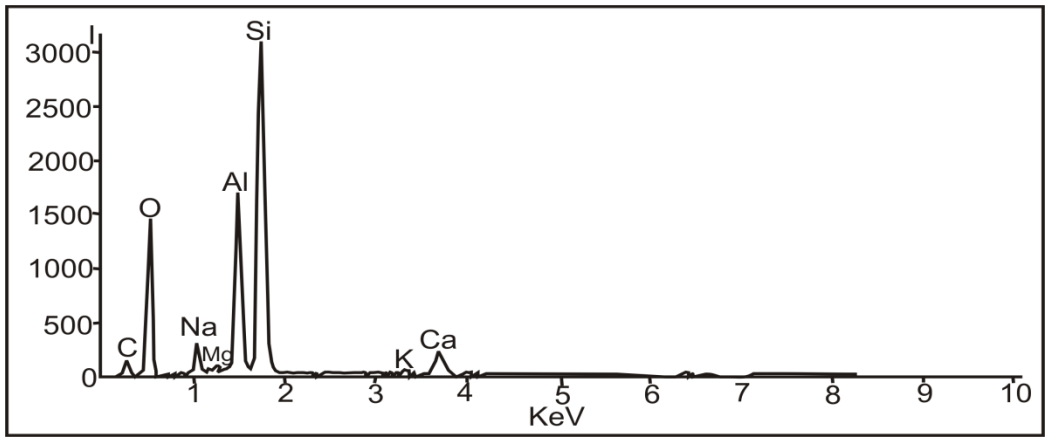
Quartz



ED spectrum of quartz



Feldspar

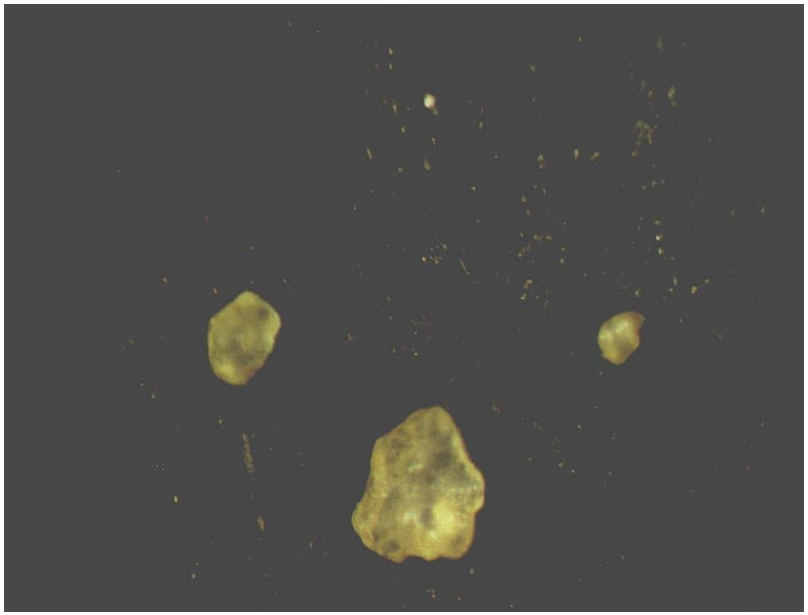


ED spectrum of feldspar

Mineral components (under the binocular microscope)

There are 4 types of quartz in the samples of snow solid residue:

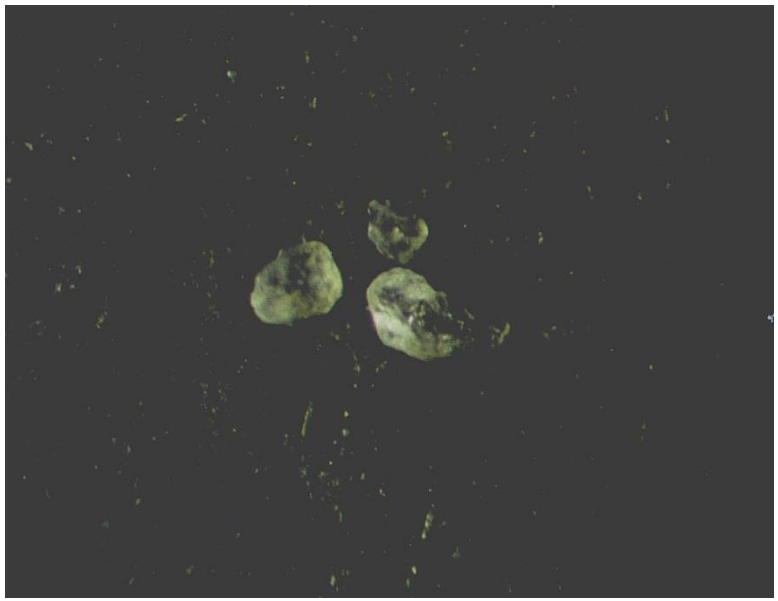
transparent, colorless, with acute edges. Size ranges from 28 μm to 1 mm



translucent, partly gravel, yellow. Size ranges from 28 μm to 1 mm

Mag. 50x

Язиков, 2006



Quartz - transparent, colourless,

Quartz covered by iron oxides – translucent, partly gravel. Size ranges from 28 µm to 1 mm.

Mag. 50x
Язиков, 2006

Mineral components (under the binocular microscope)

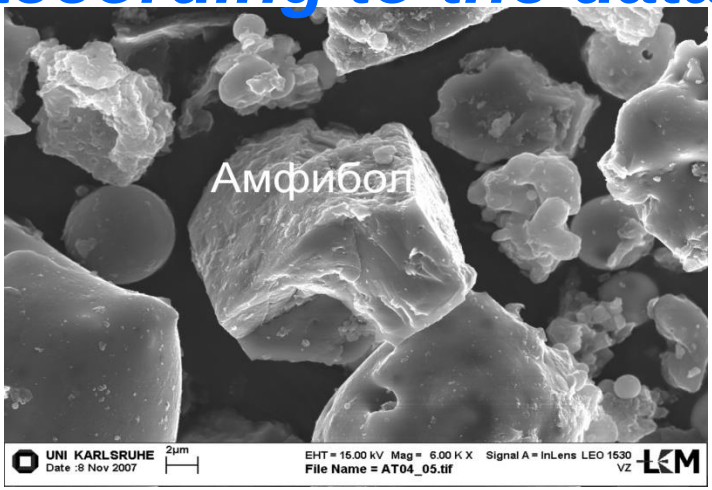
Semi-gravel, white (carbonate)
Size ranges from 30 μm to 550 μm.

Feldspar – small, right-angled, pink (feldspar)
Size ranges from 28 μm to 500 μm.

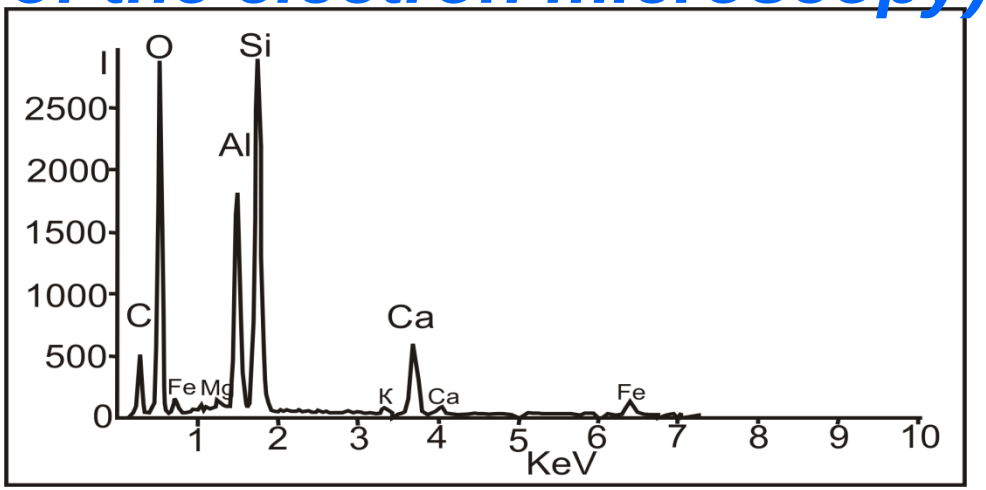
Mag. 50x

Язиков, 2006

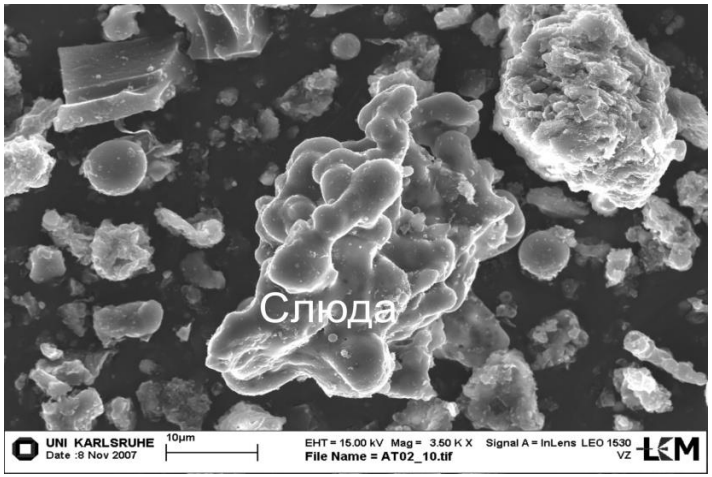
Mineral components
(according to the data of the electron microscopy)



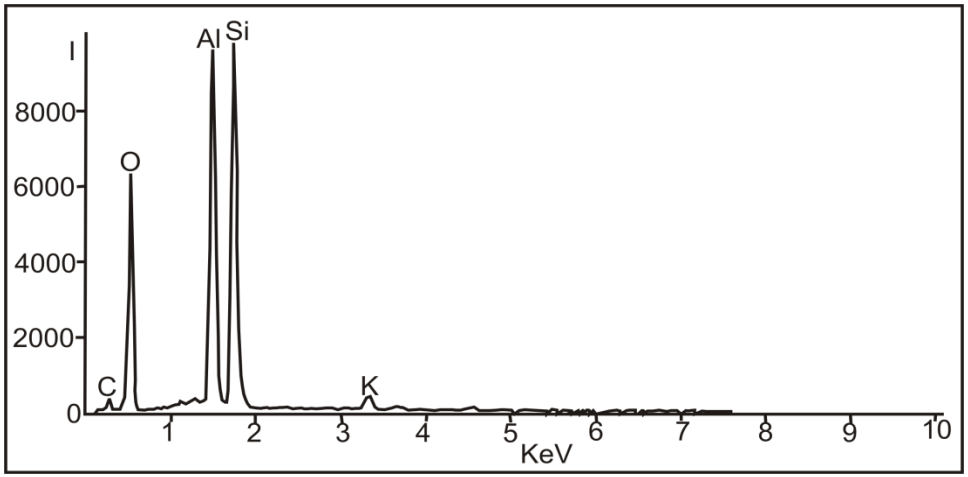
Amphibole



ED spectrum of amphibole



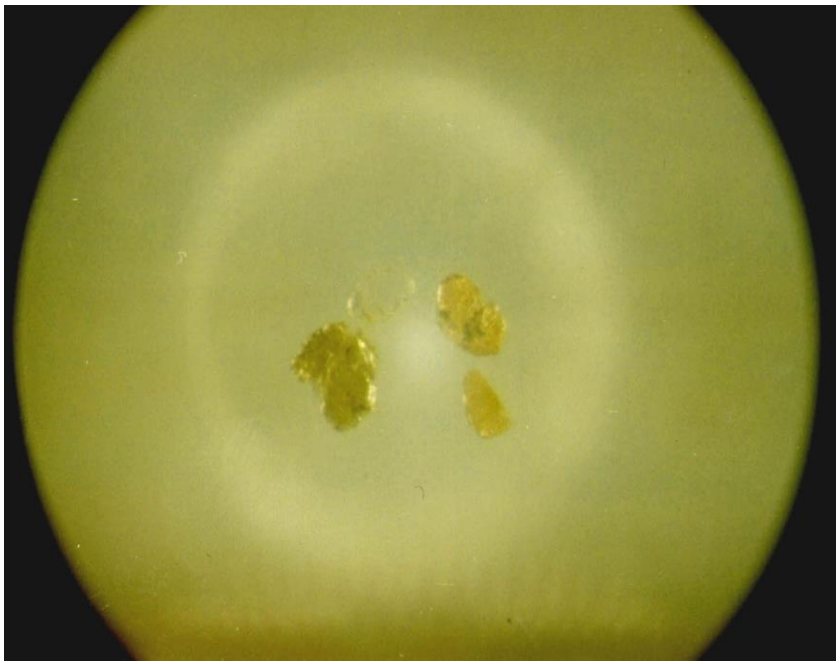
Mica



ED spectrum of mica

Mineral and organic components (under the binocular microscope)

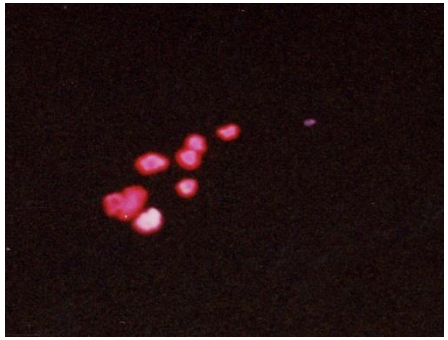
Organic particles



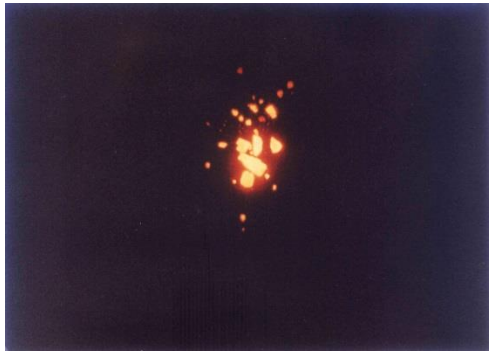
Transparent, different colors (mica)

Mag. 50x
Язиков, 2006

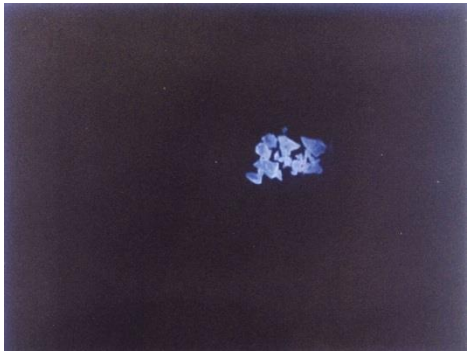
Mineral components (according to the data of the cathodic luminescence)



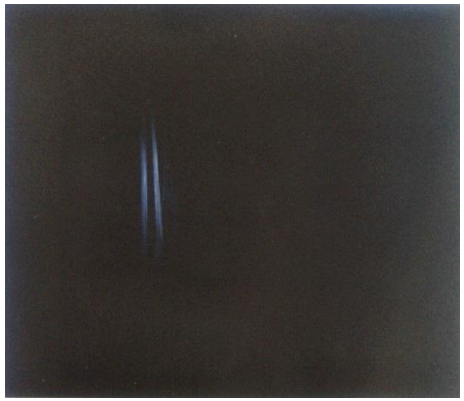
feldspar



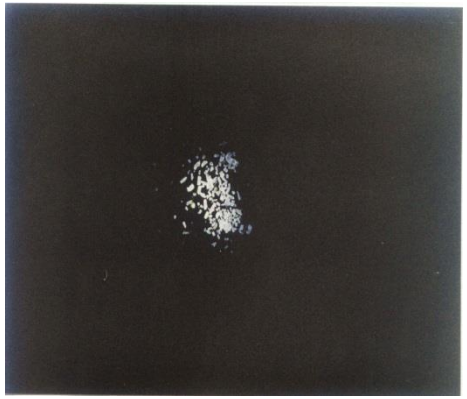
carbonate



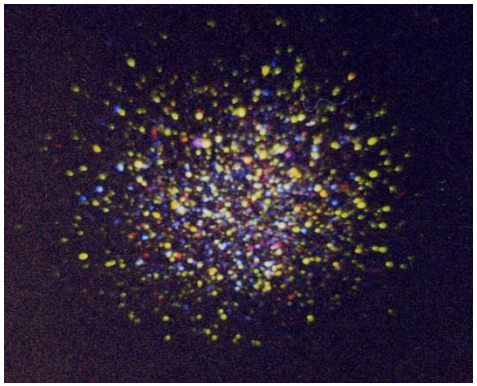
quartz



asbestos



apatite



The samples of solid residue of snow