Tomsk Polytechnic University
Institute of natural recourses
Geoecology and Geochemistry Department

Atmospheric aerosols in environment

Lecture 2
«Anthropogenic aerosol»

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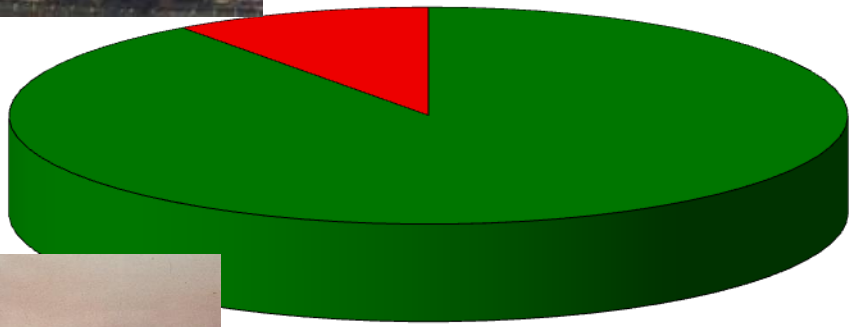
OUTLINE

1. Sources.
2. Human health effects of aerosols.

1. Sources

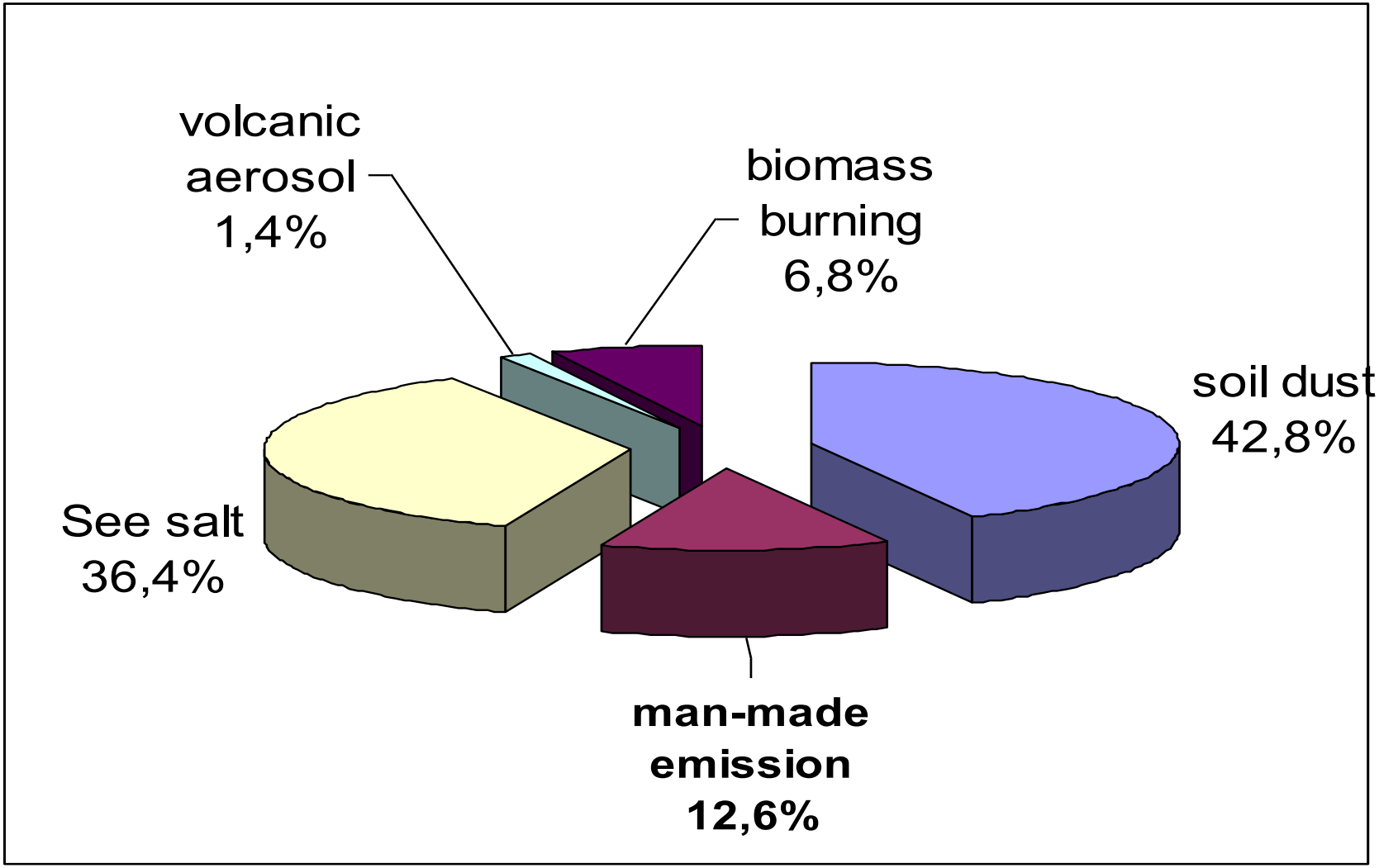
Anthropogenic aerosols, 10%



Natural aerosols, 90%

1. Primary aerosols
2. Secondary aerosols

Global balance of aerosol sources in 1980-s (Kiehl and Rodne, 1995)



Global emission estimates for primary aerosols, ml. t/year

Anthropogenic aerosols

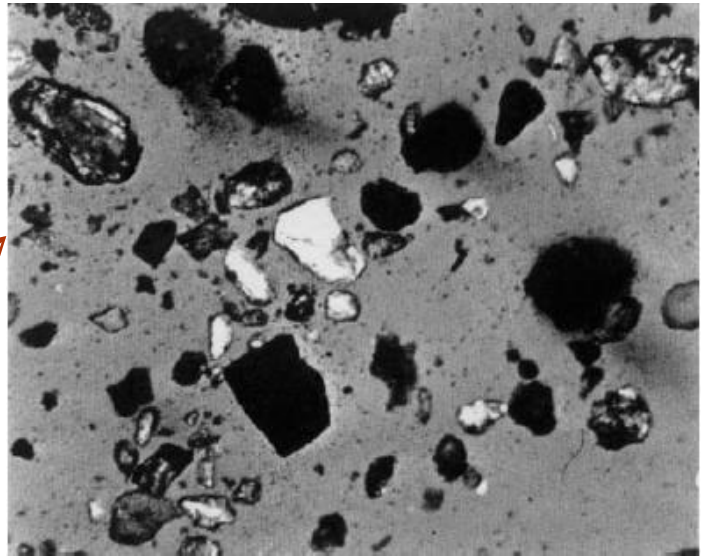
Burning fossil fuels

24-35

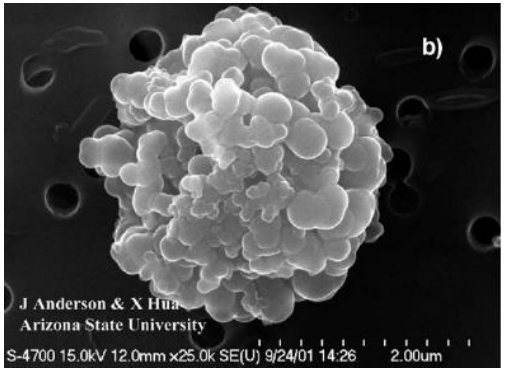
Industry, transport

80

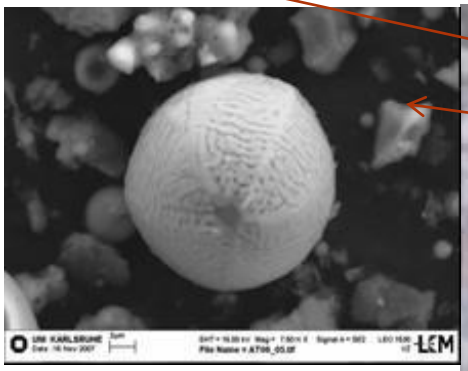
A street sample



dried leaves, glass, glass fibers, paper fibers, cement dust, hematite, limestone, olivine, coal dust, soot, and burned wood



Carbon aerosol (soot)



Fly ash

Combustion process

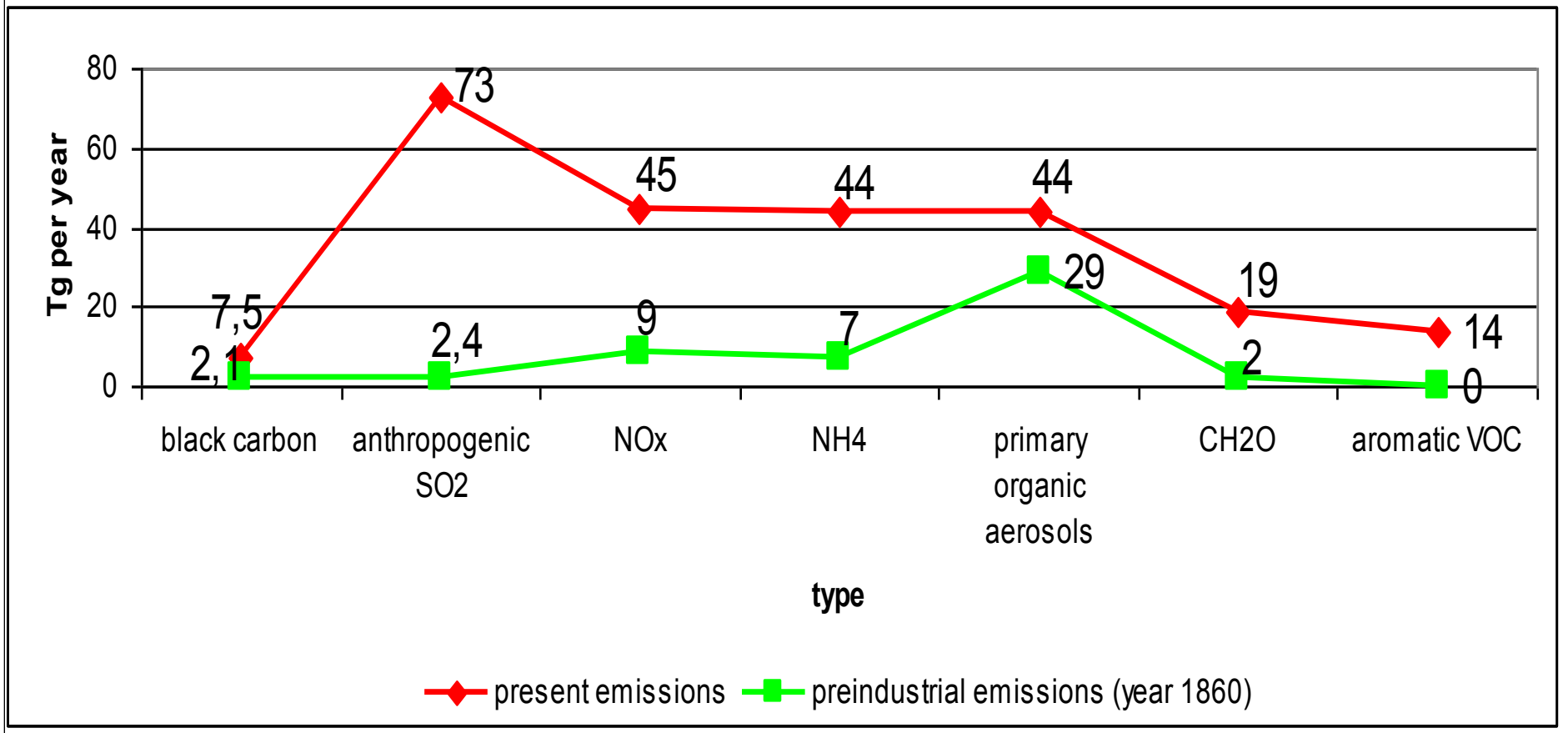
(McCrone et al., 1967)

Global emission estimates for secondary aerosols

Secondary aerosol types	Mass, ml t/year
Natural source	
Sulfates	130-200
Ammonium hydrate	80-270
Nitrates	60-430
Organic matter from biogenic volatile organic compounds	75-200
Anthropogenic source	
Sulfates	75-200
Nitrates	30-35
Organic from anthropogenic volatile organic compounds	15-90

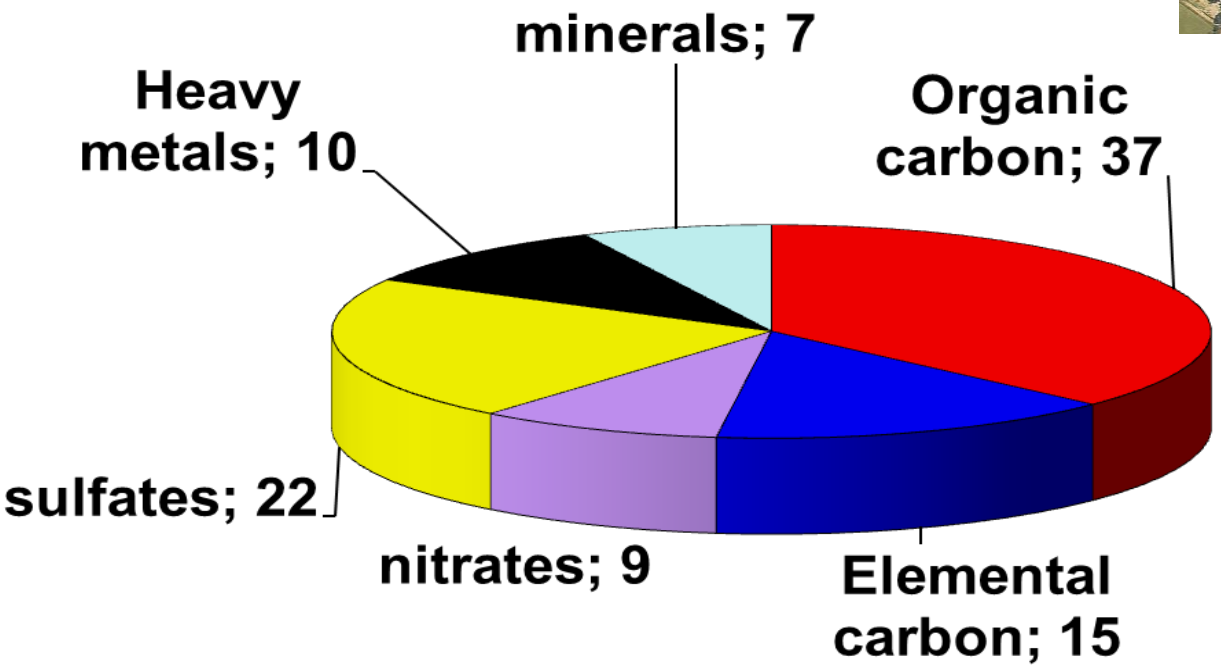
Представлен разброс имеющихся литературных данных по оценкам А.Х. Остромогильского и В.А. Петрухина, 1984

Preindustrial and present emissions in the atmosphere

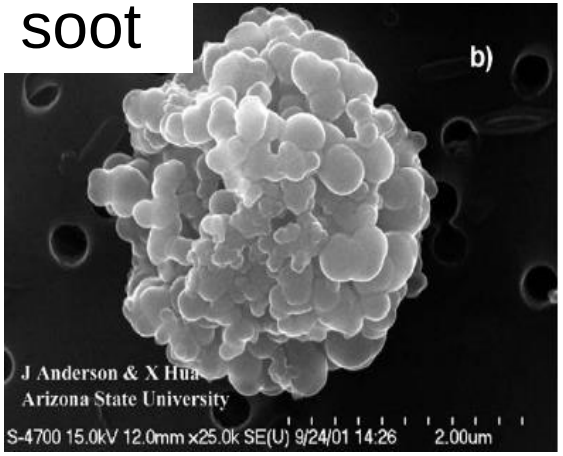


Tsigaridis et al. (2006)

Particulate matter (PM10 , PM2.5) composition in cities (%)

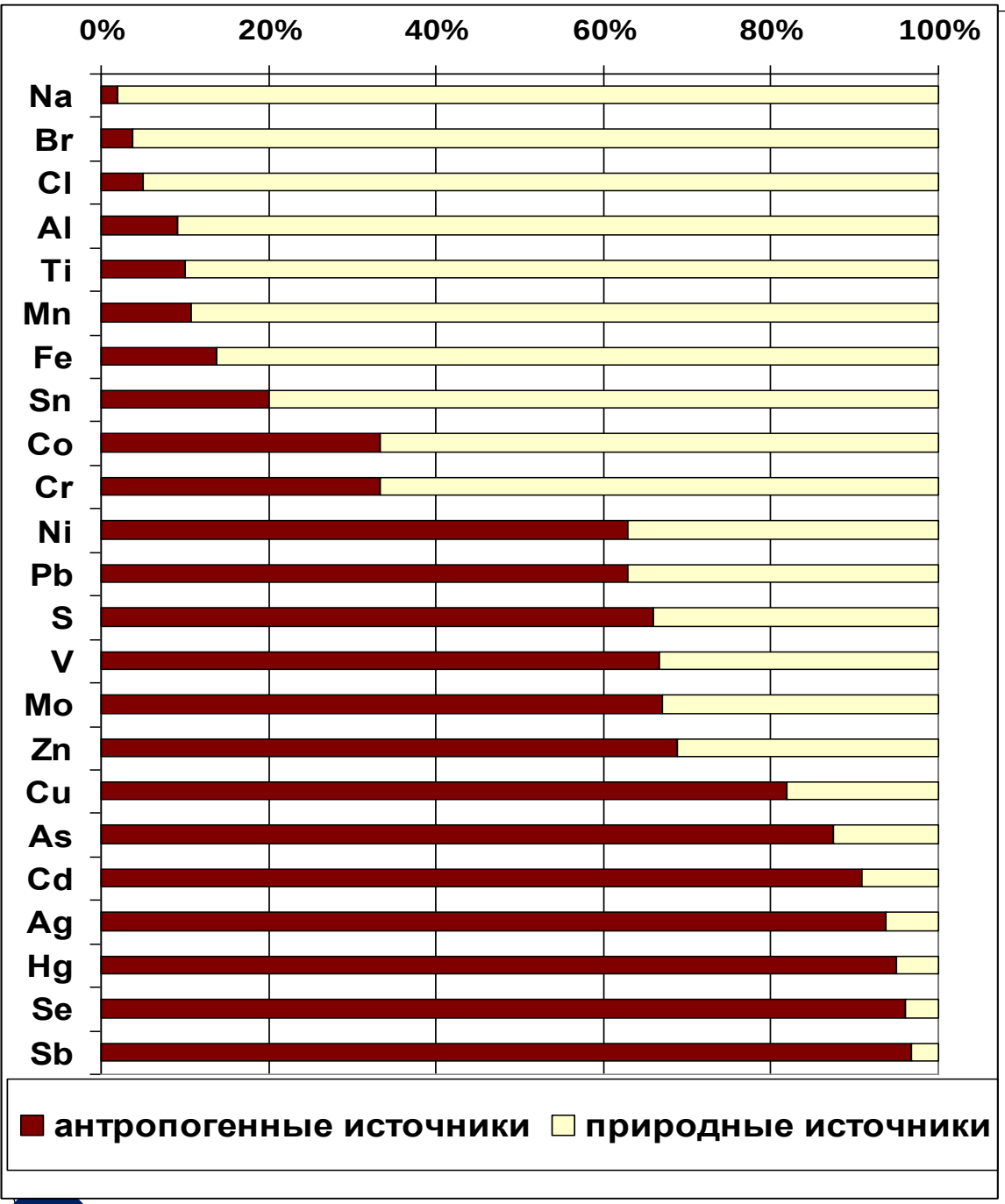


soot



Directive 1999/30/EC

Исидоров, 1982



Element concentration of atmospheric aerosol originated from anthropogenic and natural sources

Anthropogenic source

Natural source

(по оценкам А.Х. Остромогильского и В.А. Петрухина, 1984; А.А. Виноградовой, 1993):

Radioactive aerosols

Sources

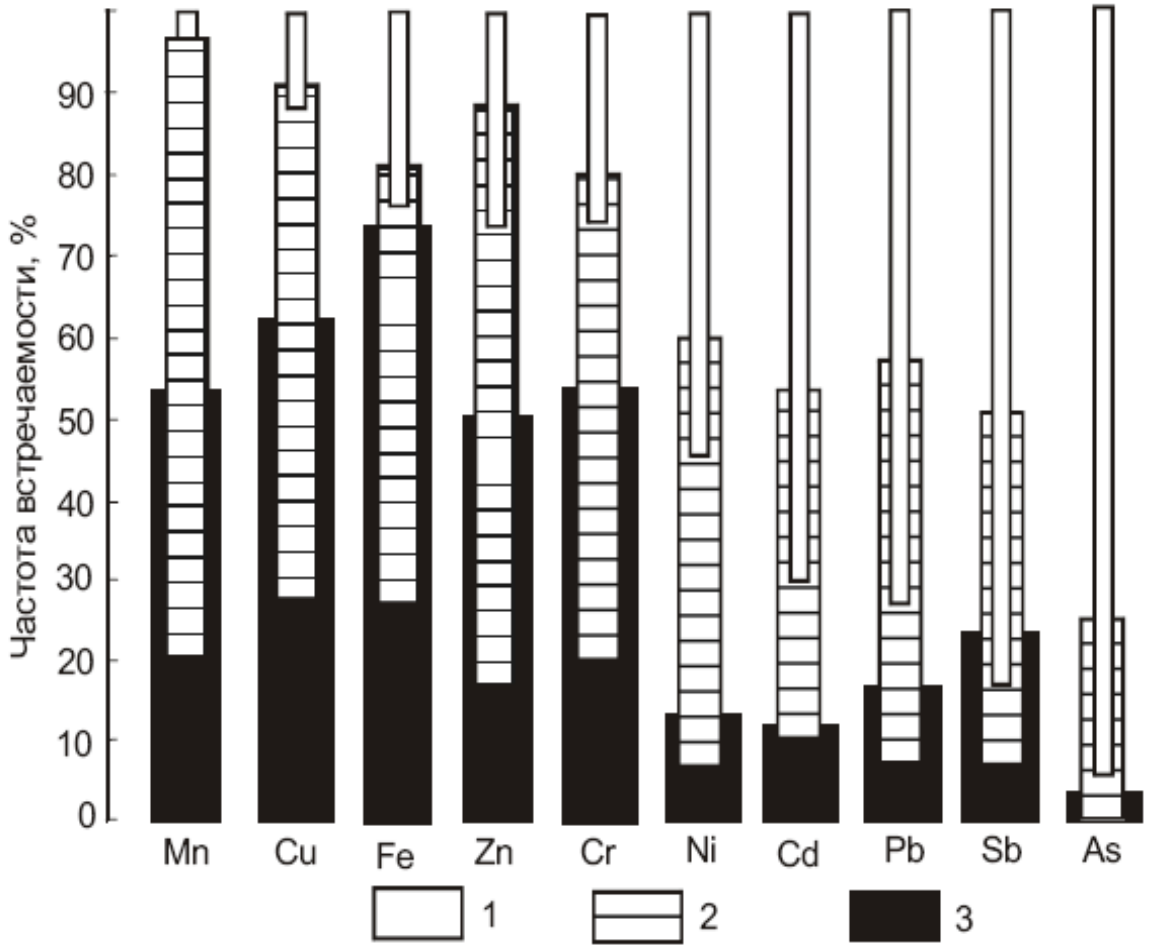
anthropogenic

The decay products of radon gas	Detonation of nuclear weapons	From nuclear reactor	Nuclear power plant

http://www.youtube.com/watch?v=9b7PwKraaek&feature=related

Several tens of seconds after an explosion, these aerosols contain about 100 different radioactive isotopes.

Element distribution in aerosols size modes, %



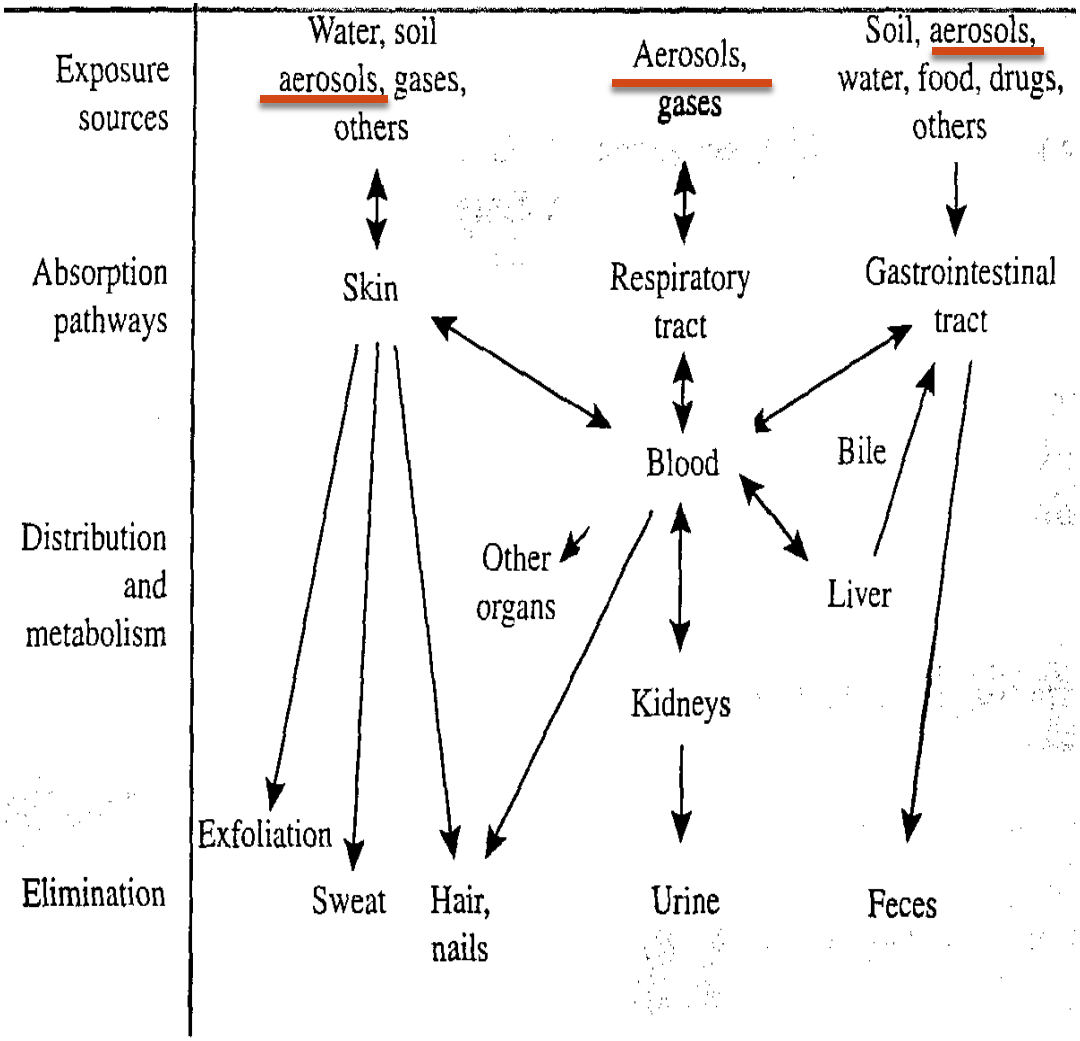
1 – ultra fine (less than 0,05 μm),

2 –fine (0,05 – 2 μm),

3 – coarse (more than 2 μm)

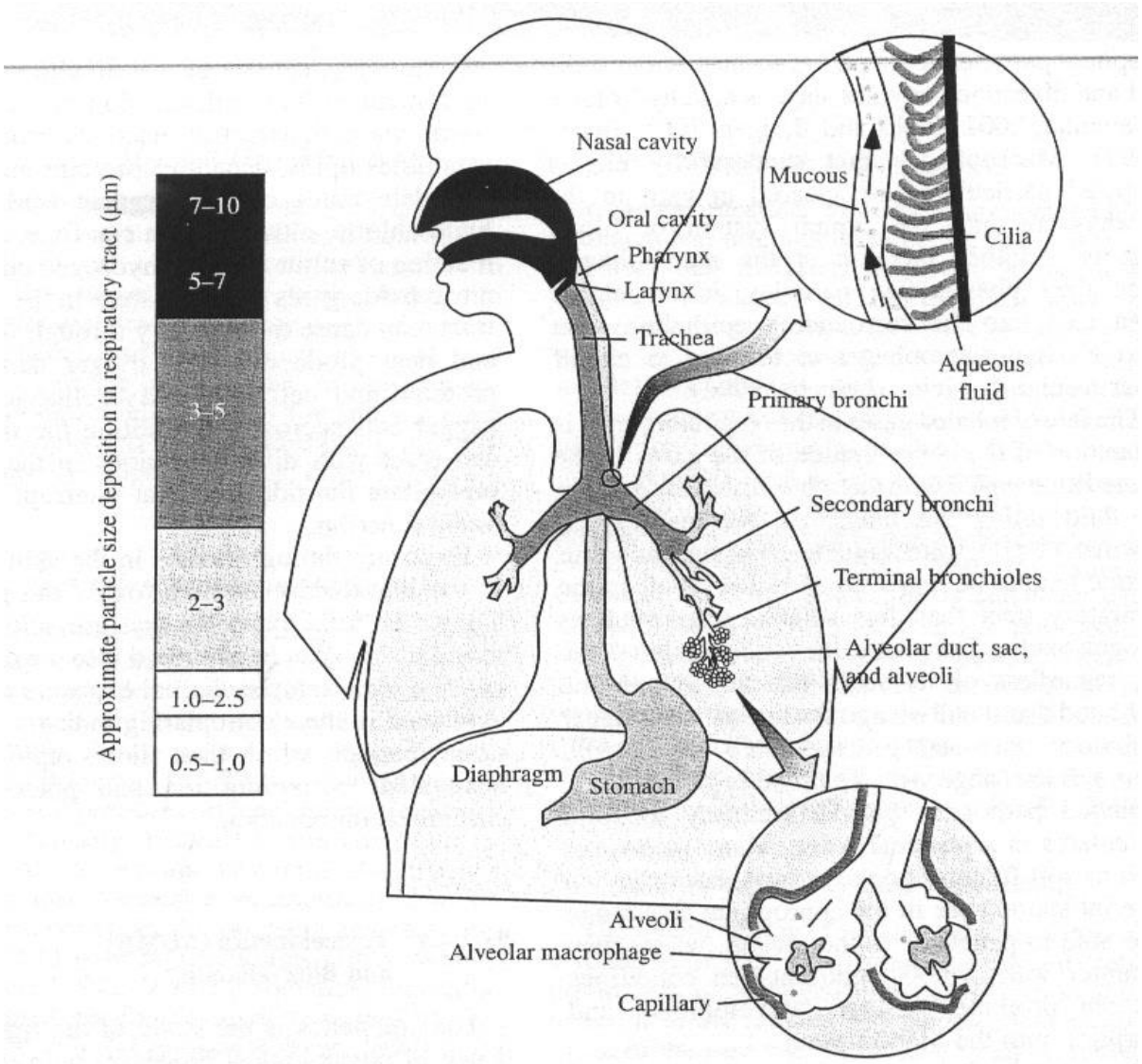
Геохимия …, 1990

2. Human health effects of aerosols



This schematic diagram shows the absorption pathways and systems of distribution, metabolism, and elimination for potential toxins. "Aerosols" include dusts, other solid particulates (such as smoke), and liquid droplets (such as fog, mists, etc.). Distribution may involve deposition of a toxin within a target organ and/or metabolism with or without excretion of the toxin by the target organ (after Goyer and Clarkson, 2001).

A schematic diagram of the respiratory system shows the fractionation of particle sizes that occurs with progressive depth in the system



(Newman, 2001)