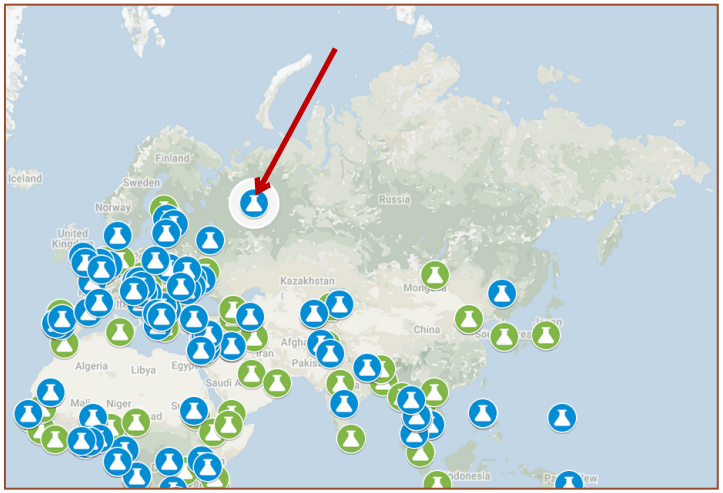
Third meeting of the Global Soil Laboratory Network
28-30 October 2019
FAO HQ | Rome, Italy

THE USE OF ATOMIC SPECTROSCOPY FOR ENVIRONMENTAL MONITORING (SOIL, PLANT MATERIALS, NATURAL WATERS)

Elena Shamrikova
Institute of Biology, Komi Science Centre, Ural Branch, Russian Academy of Sciences
shamrikovaelena@yandex.ru



Country: Russian Federation

City: Syktyvkar

Food and Agriculture Organization of the United Nations

GLOSOLAN

Global Soil Laboratory Network

CERTIFICATE OF REGISTRATION

This certificate is awarded to Ecoanalytical laboratory of the Institute of Biology of Komi Scientific Center of the Ural Branch of the Russian Academy of Sciences (Ecoanalytical laboratory, IB Komi SC UB RAS) - Russian Federation to acknowledge their official registration in the Global Soil Laboratory Network

October 2019
Food and Agriculture Organization
Rome, Italy

Mr. Eduardo Mansur
Director of the Land and Water Division,
Food and Agriculture Organization

Institute of Biology Komi Scientific Center Ural Branch Russian Academy of Sciences (**https://ib.komisc.ru**)

ФЕДЕРАЛЬНОЕ АГЕНТСТВО ПО ТЕХНИЧЕСКОМУ РЕГУЛИРОВАНИЮ И МЕТРОЛОГИИ

№ 003116

АТТЕСТАТ АККРЕДИТАЦИИ ИСПЫТАТЕЛЬНОЙ ЛАБОРАТОРИИ (ЦЕНТРА) В СИСТЕМЕ АККРЕДИТАЦИИ АНАЛИТИЧЕСКИХ ЛАБОРАТОРИЙ (ЦЕНТРОВ)

№ РОСС RU.0001.511257

Действителен до «16» апреля 2014 г.

НАСТОЯЩИЙ АТТЕСТАТ ВЫДАН Институту биологии Коми научного центра Уральского отделения Российской академии наук

167982, Российская Федерация, Республика Коми, г. Сыктывкар, ГСП-2, ул. Коммунистическая, д. 28

И УДОСТОВЕРЯЕТ, ЧТО Экоаналитическая лаборатория "ЭКОАНАЛИТ"

167982, Российская Федерация, Республика Коми, г. Сыктывкар, ГСП-2, ул. Коммунистическая, д. 28

СООТВЕТСТВУЕТ ТРЕБОВАНИЯМ ГОСТ Р ИСО/МЭК 17025 - 2006 (МЕЖДУНАРОДНОГО СТАНДАРТА ИСО/МЭК 17025: 2005).

АККРЕДИТОВАН(А) В СИСТЕМЕ АККРЕДИТАЦИИ АНАЛИТИЧЕСКИХ ЛАБОРАТОРИЙ (ЦЕНТРОВ)

НА техническую компетентность

ДЛЯ ПРОВЕДЕНИЯ РАБОТ ПО ИСПЫТАНИЯМ В СООТВЕТСТВИИ С ОБЛАСТЬЮ АККРЕДИТАЦИИ ОБЛАСТЬ АККРЕДИТАЦИИ ОПРЕДЕЛЕНА ПРИЛОЖЕНИЕМ К НАСТОЯЩЕМУ АТТЕСТАТУ И ЯВЛЯЕТСЯ ЕГО НЕОТЪЕМЛЕМОЙ ЧАСТЬЮ.

Руководитель (заместитель Руководителя) Г.И. Элькин

М.П.

Зарегистрирован в Едином реестре «16» апреля 2009 г.

Eco-analytical Laboratory accredited to the ISO/IEC 17025

GLOSOLAN

GLOBAL SOIL LABORATORY NETWORK

Employees

Eco-analytical Laboratory

20 people: 1 - Dr of Sciences, 3 - PhD,
Engineers-chemists of higher qualification






Department of Soil Science

25 people: 5 - Dr of Sciences, 8 - PhD

GLOSOLAN
GLOBAL SOIL LABORATORY NETWORK

Methods

- atomic emission spectrometry with inductively coupled plasma;
- atomic absorption spectrometry with flame and electrothermal atomization;
- x-ray fluorescence spectroscopy;
- infrared spectrometry;
- spectrophotometry;
- alpha, beta and gamma spectrometry

GLOSOLAN
GLOBAL SOIL LABORATORY NETWORK

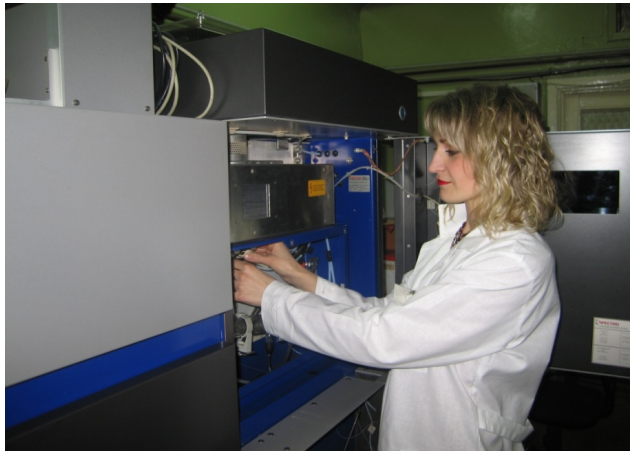
Atomic emission spectrometry with inductively coupled plasma

Spectro ARCOS (Germany) **Spectro Ciros^{CCD} (Germany)**

- multielement,
- express,
- wide measuring range,
- method sensitivity

GLOSOLAN
GLOBAL SOIL LABORATORY NETWORK

Atomic emission spectrometry with inductively coupled plasma



B, P, S, Si, Cl, Br, I
Ca, Mg, Ba, Sr, Li, K, Na,
Fe, Mn, Zn, Cu, Cd, Pb, Co, Ni, Cr, Al, Bi, Ti, V, Mo, Y

As, Se, Sb, Sn, Hg – a hydride prefix is used additionally to improve selectivity

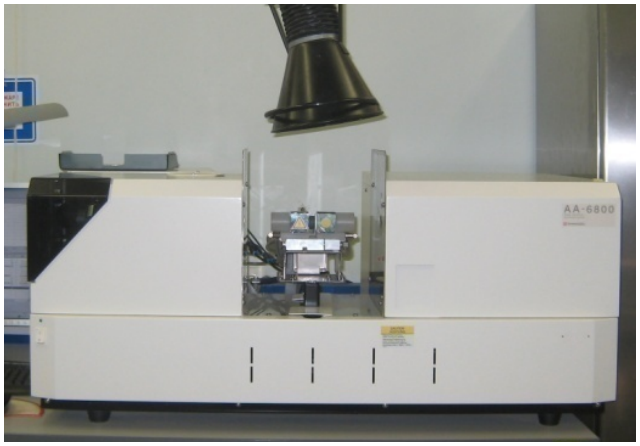
$$As\ (III, V) + BH_4^- + 6\ H^+ = AsH_3\uparrow + H_3BO_3$$

GLOSOLAN
GLOBAL SOIL LABORATORY NETWORK

Atomic absorption spectrometry

Flame atomization
Shimadzu AA-6300

Electrothermal atomization
Shimadzu AA-6800G



“Cold steam”method
Mercury analyzer
PA-915+

Cd, Pb, Cu, Ni, Co

GLOSOLAN
GLOBAL SOIL LABORATORY NETWORK

Mercury measurement scheme

"Lumex", Russia

m_{soil} = 20-500 mg

$V_{aliquot}$ = 1-40 cm^3

Analysis result
in
ng/g, µg /dm^3

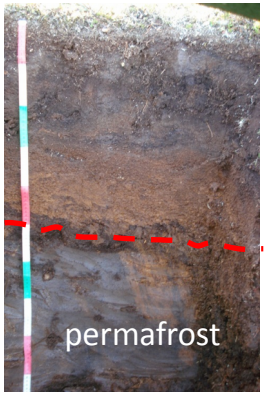
$Hg(II) \longrightarrow Hg^0$

$Sn^{2+} + Hg^{2+} \longrightarrow Hg^0 + Sn^{4+}$

GLOSOLAN
GLOBAL SOIL LABORATORY NETWORK

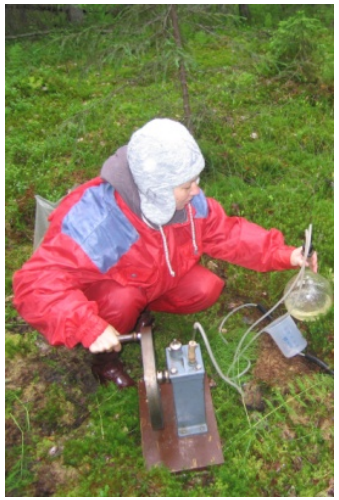
Subjects of the research

Solid samples

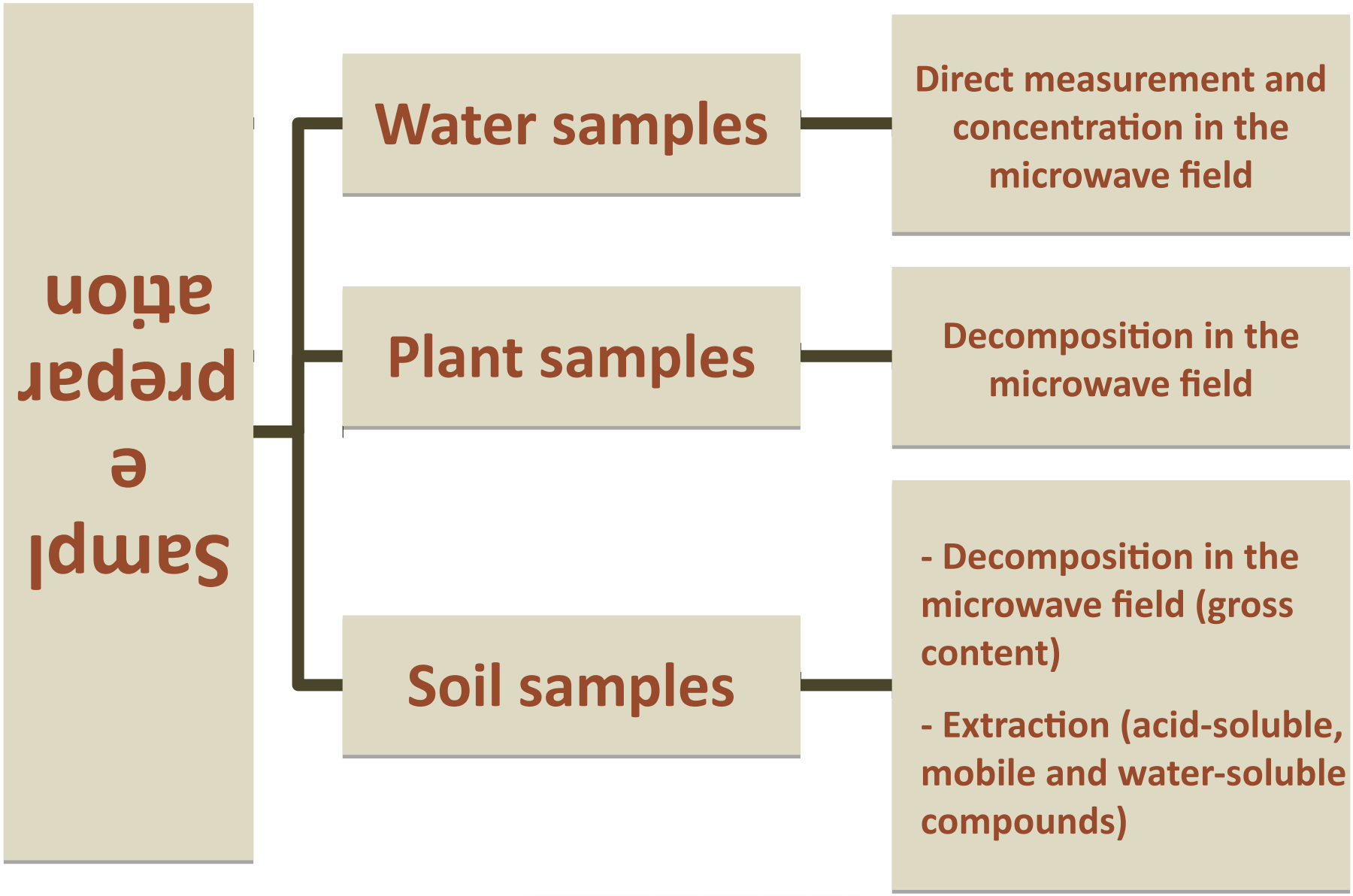


Liquid samples

- Natural waters
- Precipitation
- Snow cover



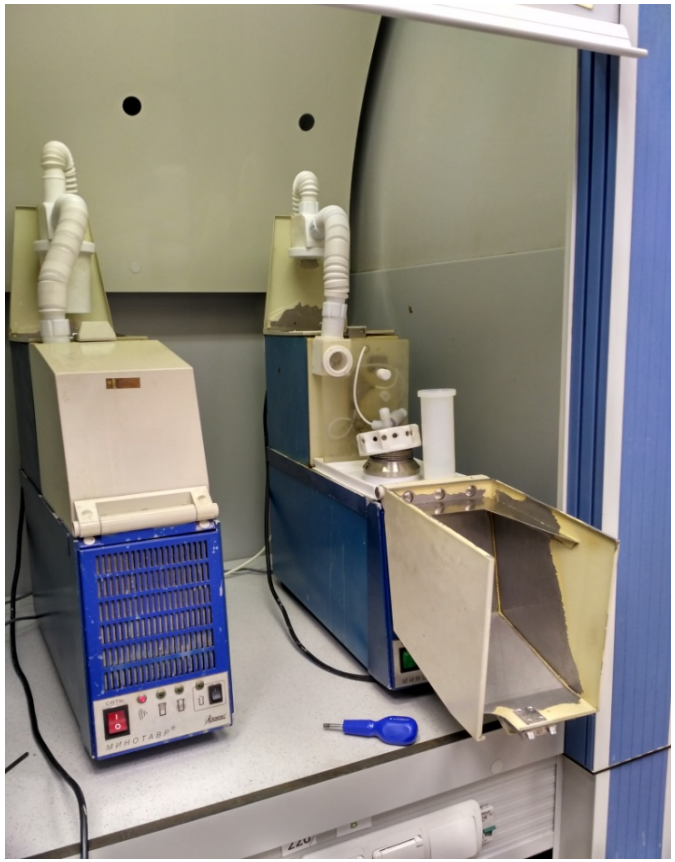
GLOSOLAN
GLOBAL SOIL LABORATORY NETWORK



GLOSOLAN
GLOBAL SOIL LABORATORY NETWORK

Microwave opening process

"Minotavr-2"
("Lumex", Russia)

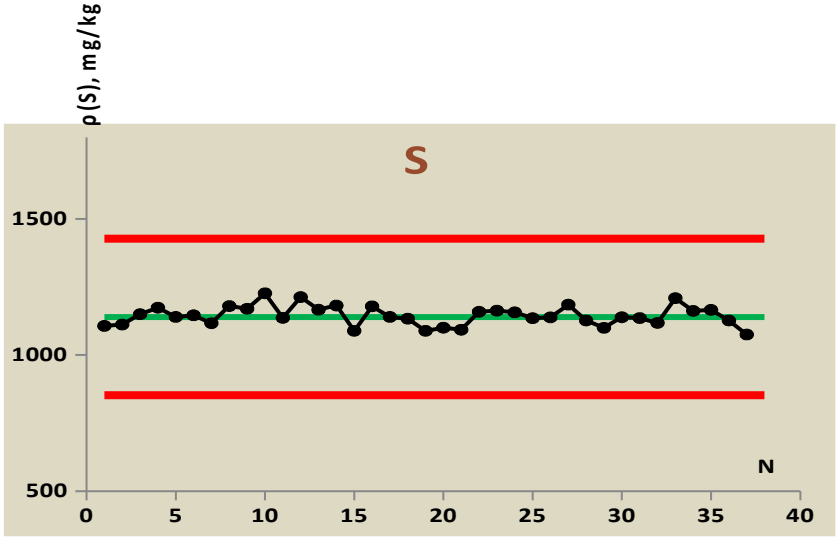


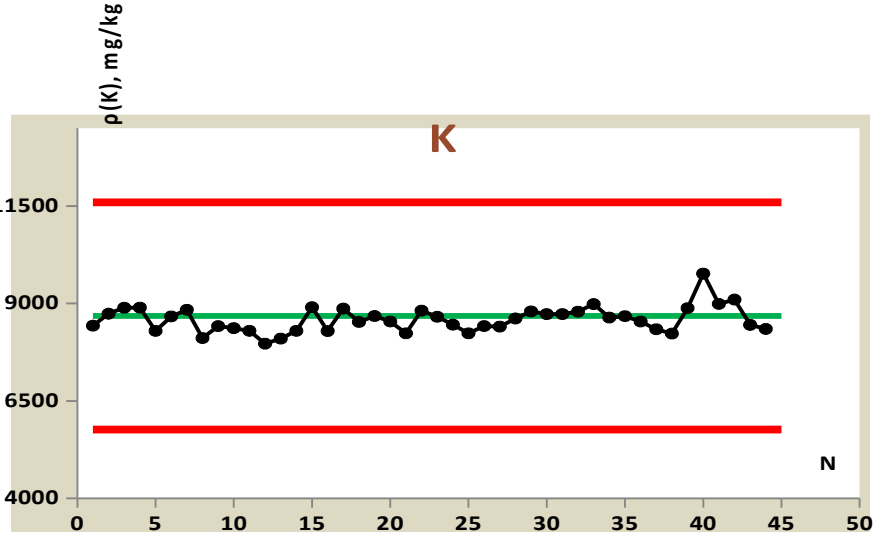
P = 8 atm., *T* = 200 ˚C

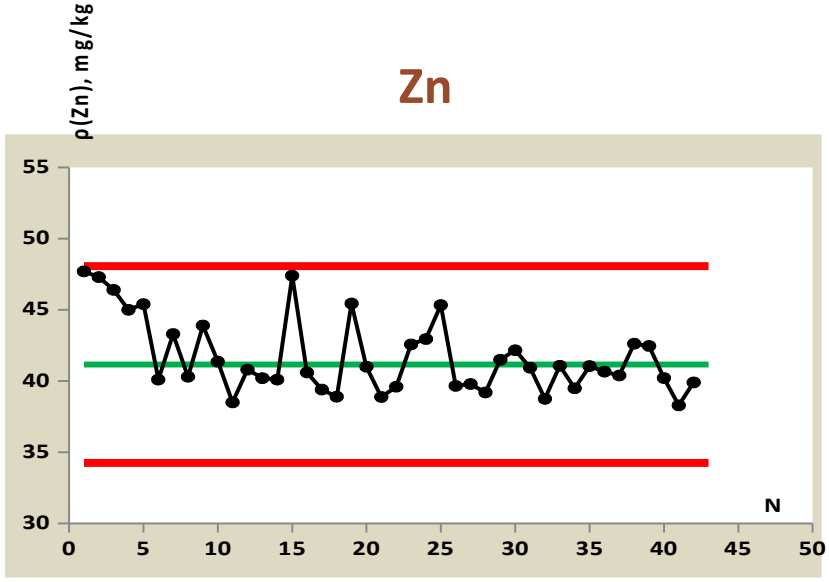
"Mars-5"
(CEM Corporation, USA)

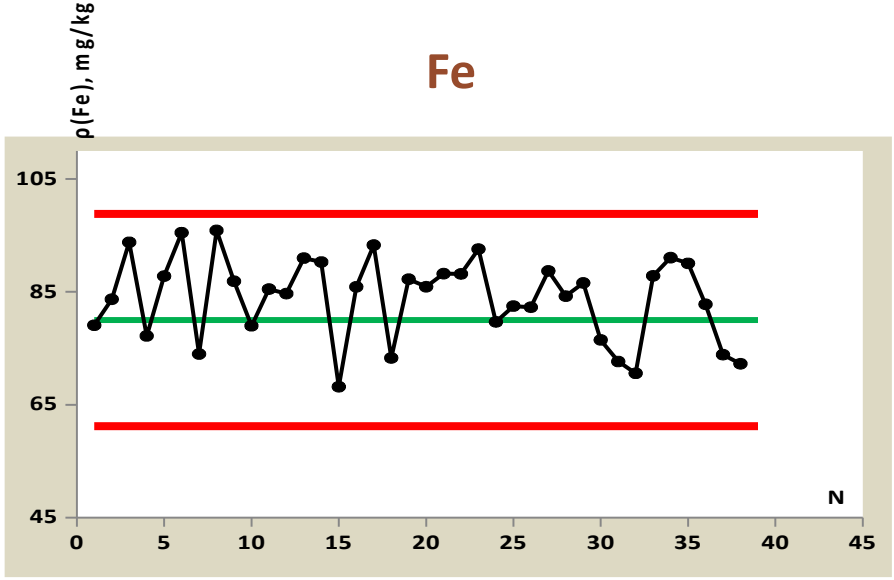
P = 50 atm., *T* = 200 ˚C

Measurement quality control









Proficiency testing

Water samples

Since 1998
The intercomparison tests (ICP Waters)
NIVA, Norway

pH, Conductivity, Alkalinity, $N\text{-}NO_3^-$, Cl^-, SO_4^{2-}, Total P, TOC, Ca, Mg, K, Na, Fe, Mn, Zn, Al, Cd, Pb, Cu, Ni

Since 2005
ICP Forests Deposition and Soil Solution Working Ring Tests (ICP Forests)
IBL, Poland

pH, Conductivity, Alkalinity, $N\text{-}NH_4^+$, $N\text{-}NO_3^-$, Cl^-, $S\text{-}SO_4^{2-}$, $P\text{-}PO_4^{3-}$, DOC, Total N, Ca, Mg, K, Na, Fe, Mn, Zn, Al, Cd, Pb, Cu, Ni, Co, Cr

Soil samples

Since 2007
ICP Forests Soil Interlaboratory Comparisons (ICP Forests)
CFI, Croatia

Moisture content, Particle size distribution, pH ($CaCl_2$), pH (H_2O), Exchangeable Acidity, Free H^+ Acidity, Reactive Fe and Al, $CaCO_3$, Organic carbon, Total N, Exchangeable cations (Ca, Mg, K, Na, Al, Fe, Mn), Aqua Regia extractable elements (S, P, Ca, K, Mg, Na, Fe, Mn, Zn, Cu, Pb, Cd, Ni, Cr, Al), Total content (Ca, K, Mg, Na, Fe, Mn, Al, Hg)

Plant samples

Since 2007
Needle/Leaf Interlaboratory Comparison Tests (ICP Forests)
BFW, Austria

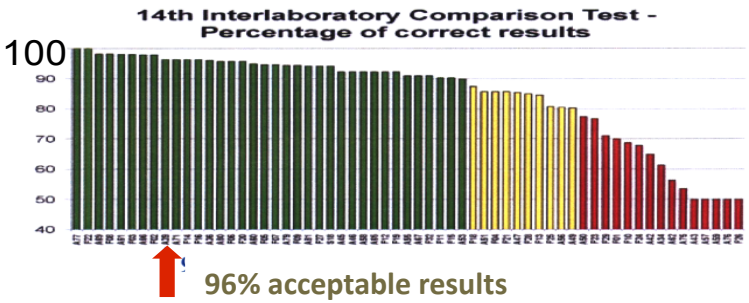
N, C, S, P, B, Ca, Mg, K, Na, Sr, Zn, Mn, Fe, Cu, Cr, Pb, Cd, Co, Ni, Ba, Al, V, Mo, Ti, Se, As, Hg

GLOSOLAN
GLOBAL SOIL LABORATORY NETWORK

Proficiency testing / ICP-Forest

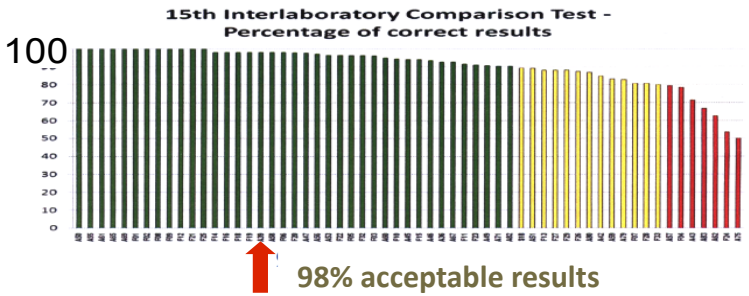
Proportion of satisfactory measurement results %

2011 / 2012



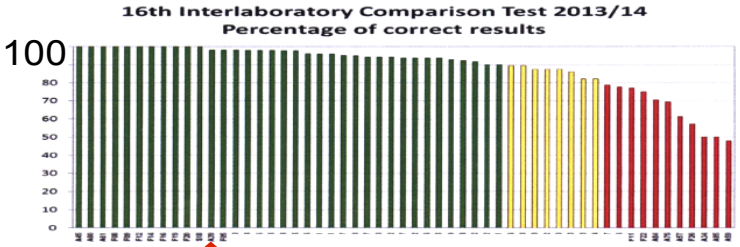
96% acceptable results

2013 / 2014



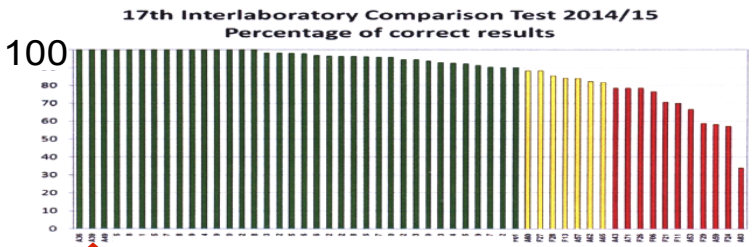
98% acceptable results

2012 / 2013



98% acceptable results

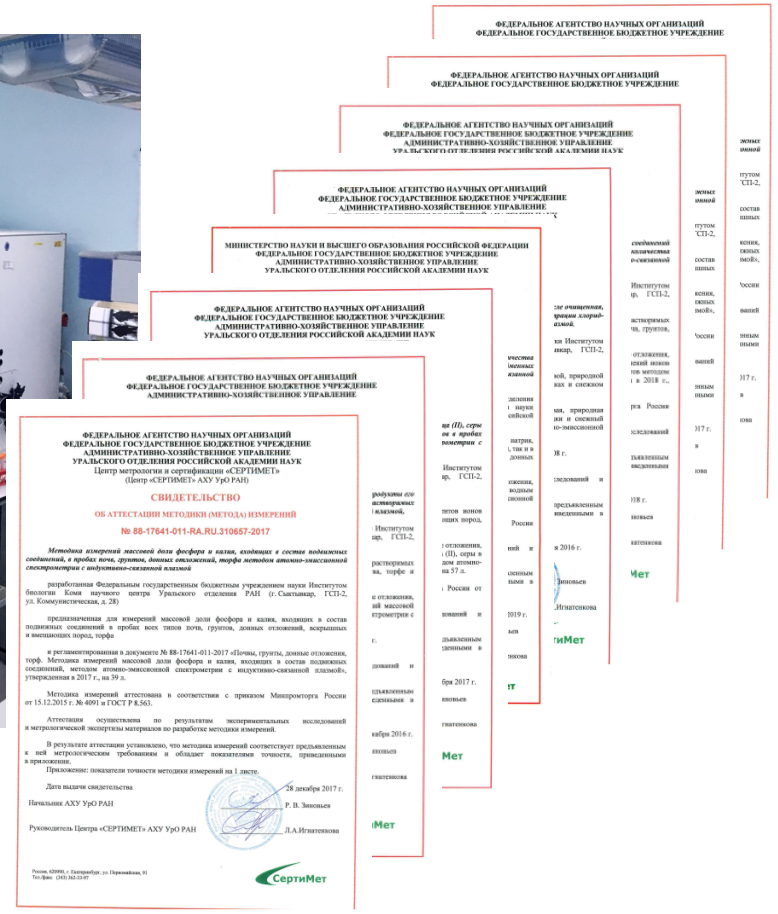
2014 / 2015



100% acceptable results

GLOSOLAN
GLOBAL SOIL LABORATORY NETWORK

30 measurement procedures were developed and/or metrologically certified in the lab



ФЕДЕРАЛЬНОЕ АГЕНТСТВО НАУЧНЫХ ОРГАНИЗАЦИЙ
ФЕДЕРАЛЬНОЕ ГОСУДАРСТВЕННОЕ БЮДЖЕТНОЕ УЧРЕЖДЕНИЕ
АДМИНИСТРАТИВНО-ХОЗЯЙСТВЕННОЕ УПРАВЛЕНИЕ
УРАЛЬСКОГО ОТДЕЛЕНИЯ РОССИЙСКОЙ АКАДЕМИИ НАУК
Центр метрологии и сертификации «СЕРТИМЕТ»
(Центр «СЕРТИМЕТ» АХУ УрО РАН)

СВИДЕТЕЛЬСТВО

ОБ АТТЕСТАЦИИ МЕТОДИКИ (МЕТОДА) ИЗМЕРЕНИЙ

№ 88-17641-011-RA.RU.310657-2017

Методика измерений массовой доли фосфора и калия, входящих в состав подвижных соединений, в пробах почв, грунтов, донных отложений, торфа методом атомно-эмиссионной спектрометрии с индуктивно-связанной плазмой

разработанная Федеральным государственным бюджетным учреждением науки Институтом биологии Коми научного центра Уральского отделения РАН (г. Сыктывкар, ГСП-2, ул. Коммунистическая, д. 28)

предназначенная для измерений массовой доли фосфора и калия, входящих в состав подвижных соединений в пробах всех типов почв, грунтов, донных отложений, вскрышных и вмещающих пород, торфа

и регламентированная в документе № 88-17641-011-2017 «Почвы, грунты, донные отложения, торф. Методика измерений массовой доли фосфора и калия, входящих в состав подвижных соединений, методом атомно-эмиссионной спектрометрии с индуктивно-связанной плазмой», утвержденная в 2017 г., на 39 л.

Методика измерений аттестована в соответствии с приказом Минпромторга России от 15.12.2015 г. № 4091 и ГОСТ Р 8.563.

Аттестация осуществлена по результатам экспериментальных исследований и метрологической экспертизы материалов по разработке методики измерений.

В результате аттестации установлено, что методика измерений соответствует предъявленным к ней метрологическим требованиям и обладает показателями точности, приведенными в приложении.

Приложение: показатели точности методики измерений на 1 листе.

Дата выдачи свидетельства 28 декабря 2017 г.

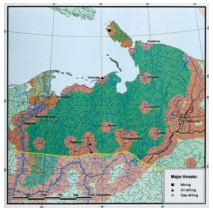
Начальник АХУ УрО РАН Р. В. Зиновьев

Руководитель Центра «СЕРТИМЕТ» АХУ УрО РАН Л.А.Игнатенкова

СертиМет

GLOSOLAN
GLOBAL SOIL LABORATORY NETWORK

Approbation

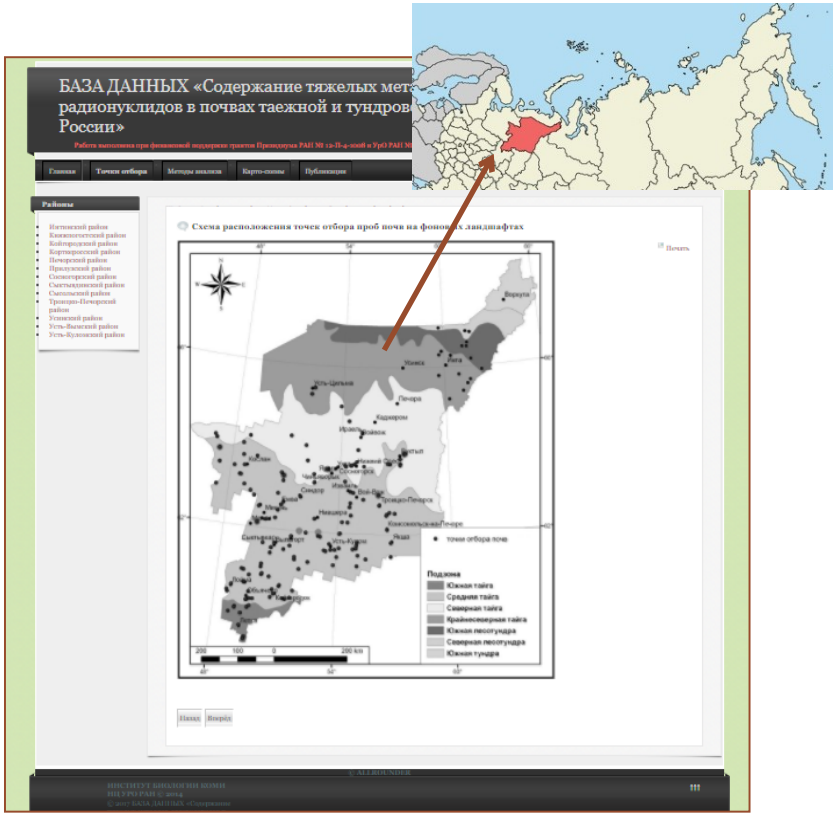


Background content of elements in soils of the North of the Bolshezemelskaya tundra (*S* ~ 90000 km²)

Type of soil	*n*	As	Pb	Zn	Cu	Ni	Cd	Hg, µg/kg
		mg/kg						
Entic Podzols	11	4.6± 2.6	8.7± 3.7	39.5± 15.4	9.5± 2.3	17.0± 6.5	0.3± 0.1	39.4± 36.8
Stagnic Cambisols, Gleysols	11	4.8± 3.0	11.9± 7.0	49.0± 24.2	10.8± 1.9	23.0± 4.8	0.3± 0.2	55.7± 61.7
Histic Gleysols, Histic Cryosols	17	1.9± 1.7	8.0± 1.3	35.6± 17.3	7.4± 5.0	12.9± 11.5	0.2± 0.1	78.2± 54.3
Histosols	32	3.1± 6.6	5.0± 3.4	19± 13	3.7± 2.3	5.7± 4.0	0.3± 0.4	118.5± 59.6
Fluvisols	17	2.9± 0.9	5.2± 1.7	26± 16	5.7± 2.8	13.2± 4.8	0.2± 0.1	16.5± 16.4

The level of elements

Background content of heavy metals in soils of the European North-East of Russia (*S* = 416000 km²)



http://ib.komisc.ru/db/heavymetal

GLOSOLAN
GLOBAL SOIL LABORATORY NETWORK

Approbation

ISSN 1064-2293, Eurasian Soil Science, 2007, Vol. 40, No. 9, pp. 949–955. © Pleiades Publishing, Ltd., 2007.
Original Russian Text © V.A. Beznosikov, E.D. Lodygin, B.M. Kondratenok, 2007, published in Pochvovedenie, 2007, No. 9, pp. 1064–1070.

SOIL CHEMISTRY

Assessment of Background Concentrations of Heavy Metals in Soils of the Northeastern Part of European Russia

V. A. Beznosikov, E. D. Lodygin, and B. M. Kondratenok
Institute of Biology, Komi Science Center, Ural Division, Russian Academy of Sciences, Kommunisticheskaya ul. 28,

ISSN 1064-2293, Eurasian Soil Science, 2014, Vol. 47, No. 3, pp. 162–172. © Pleiades Publishing, Ltd., 2014.
Original Russian Text © R.S. Vasilevich, V.A. Beznosikov, E.D. Lodygin, B.M. Kondratenok, 2014, published in Pochvovedenie, 2014, No. 3, pp. 283–294.

SOIL CHEMISTRY

Complexation of Mercury(II) Ions with Humic Acids in Tundra Soils

R. S. Vasilevich, V. A. Beznosikov, E. D. Lodygin, and B. M. Kondratenok
Institute of Biology, Komi Research Center, Urals Branch, Russian Academy of Sciences, ul. Kommunisticheskaya 28, Syktyvkar, 167982 Russia

ISSN 1064-2293, Eurasian Soil Science, 2019, Vol. 52, No. 7, pp. 769–777. © Pleiades Publishing, Ltd., 2019.
Russian Text © The Author(s), 2019, published in Pochvovedenie, 2019, No. 7, pp. 817–826.

SOIL CHEMISTRY

Sorption of Cu^{2+} and Zn^{2+} Ions by Humic Acids of Tundra Peat Gley Soils (Histic Reductaquic Cryosols)

E. D. Lodygin*

ISSN 1064-2293, Eurasian Soil Science, 2018, Vol. 51, No. 11, pp. 1309–1316. © Pleiades Publishing, Ltd., 2018.
Original Russian Text © E.D. Lodygin, 2018, published in Pochvovedenie, 2018, No. 11, pp. 1322–1329.

SOIL CHEMISTRY

Content of Acid-Soluble Copper and Zinc in Background Soils of Komi Republic

E. D. Lodygin*
Institute of Biology, Komi Scientific Center, Ural Division, Russian Academy of Sciences, Syktyvkar, 167982 Komi Republic, Russia

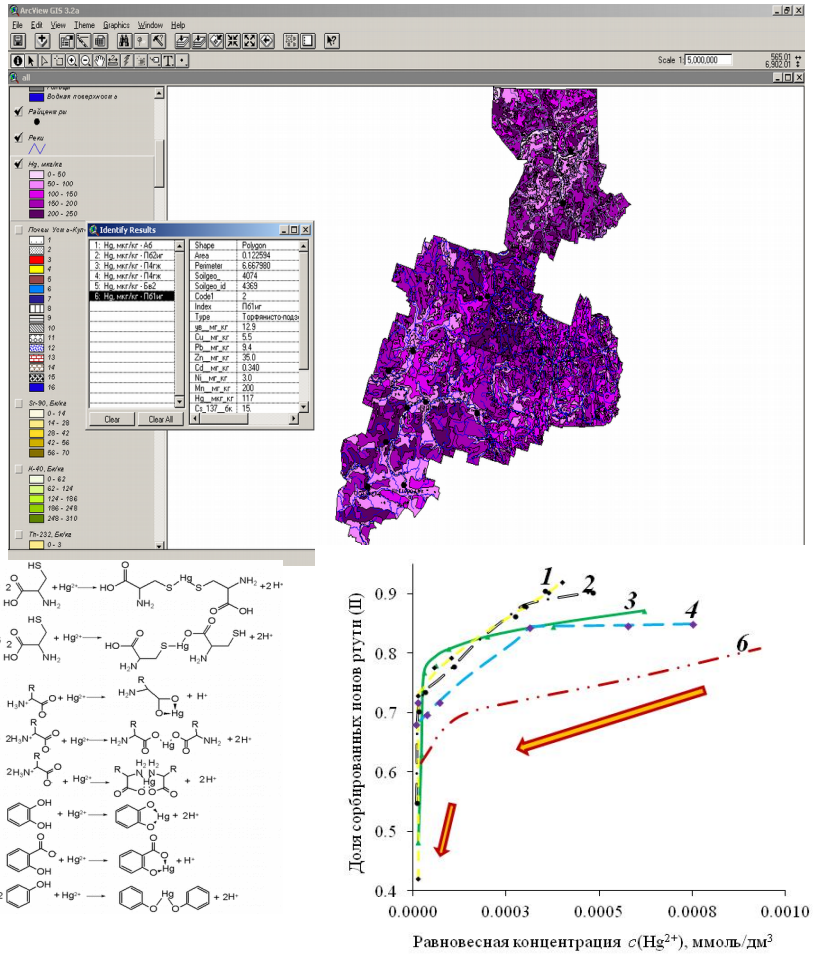
ISSN 0016-7029, Geochemistry International, 2018, Vol. 56, No. 12, pp. 1276–1288. © Pleiades Publishing, Ltd., 2018.
Original Russian Text © R.S. Vasilevich, 2018, published in Geokhimiya, 2018, No. 12, pp. 1158–1172.

Major and Trace Element Compositions of Hummocky Frozen Peatlands in the Forest–Tundra of Northeastern European Russia

R. S. Vasilevich*
Institute of Biology, Komi Research Center, Ural Branch, Russian Academy of Sciences, Syktyvkar, 167982 Russia
*e-mail: vasilevich.r.s@ib.komisc.ru

Received January 11, 2018; accepted January 18, 2018

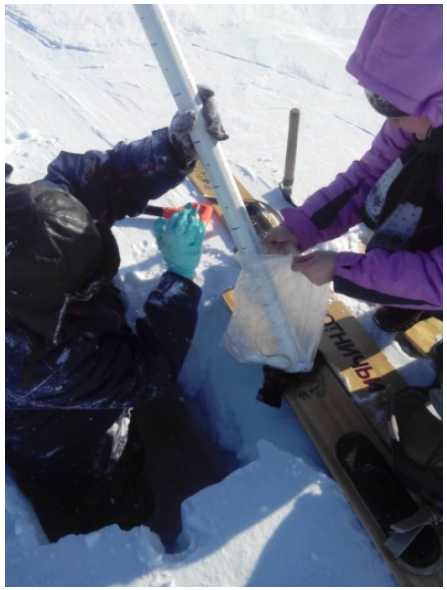
Hg content in soils (S ~ 105000 km²)



Isotherms of mercury ion sorption by humic acid preparations of tundra soils

GLOSOLAN
GLOBAL SOIL LABORATORY NETWORK

Approbation



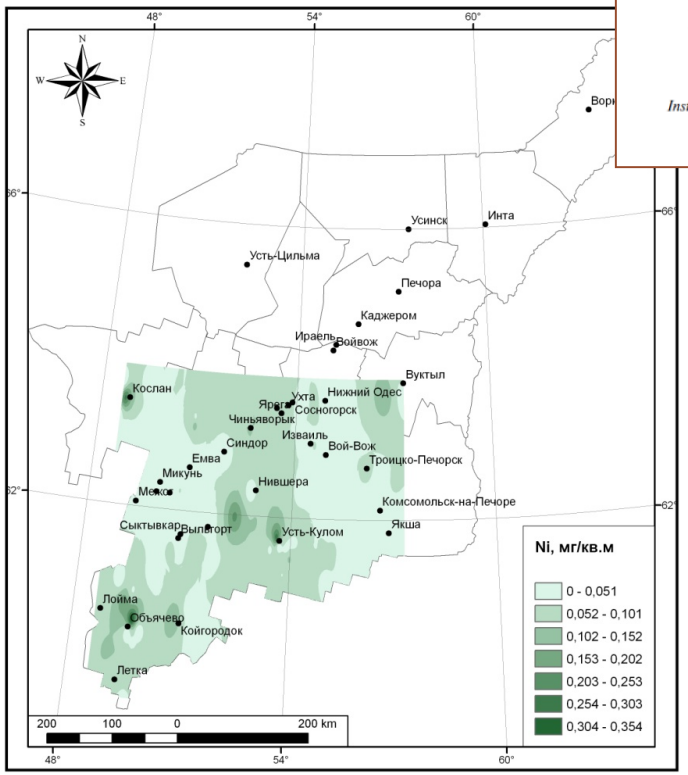
ISSN 0097-8078, Water Resources, 2018, Vol. 45, No. 3, pp. 338–347. © Pleiades Publishing, Ltd., 2018.
Original Russian Text © M.I. Vasilevich, R.S. Vasilevich, E.V. Shmarkova, 2018, published in Vodnye Resursy, 2018, Vol. 45, No. 3, pp. 00000–00000.

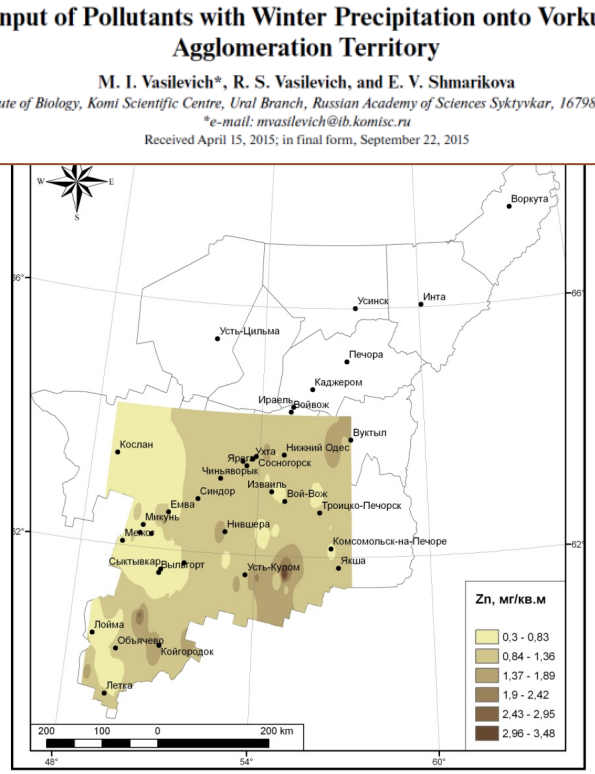
HYDROCHEMISTRY, HYDROBIOLOGY: ENVIRONMENTAL ASPECTS

Input of Pollutants with Winter Precipitation onto Vorkuta Agglomeration Territory

M. I. Vasilevich*, R. S. Vasilevich, and E. V. Shmarikova
Institute of Biology, Komi Scientific Centre, Ural Branch, Russian Academy of Sciences Syktyvkar, 167982 Russia
*e-mail: mvasilevich@ib.komisc.ru

Received April 15, 2015; in final form, September 22, 2015





Heavy metal content (Mn, Fe, Cu, Ni, Zn, Cd, Co, Al, Pb) in snow,
S ~ 300000 km^2

GLOSOLAN
GLOBAL SOIL LABORATORY NETWORK

How strong is our laboratory?

- The lab's activities comply with the provisions of the international standard 17025. It also has an effective quality management system
- The lab is provided with modern analytical equipment and supported by well-trained personnel majority of whom are employees with higher chemical education
- The lab is maintained by qualified scientific support represented by employees of the soil science department
- In its activities the lab implements a set of methods for quantitative chemical analysis of environmental objects' samples, including soils
- The lab is constantly involved in international inter-laboratory comparative tests
- 30 measurement procedures were developed and/or metrologically certified in the lab

About the needs of our laboratory

- **Firstly, the need for reference samples for ICP AES.** In Russia, they simply do not exist.
- **Secondly, reference samples of soils and plants.** There are no high-quality samples in Russia either.
- **Additionally,** an exchange of international experience could be discussed.

Thank you for attention

VIII Congress of the Society of Soil Scientists named after V.V. Dokuchaev,
August 10-14 (2020), Syktyvkar

https://ib.komisc.ru/add/conf/soil2020/

GLOSOLAN
GLOBAL SOIL LABORATORY NETWORK