June 2009

MEDICAL GEOLOGY NEWSLETTER

International Medical Geology Association

Website: www.medicalgeology.org

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SEE PAGE 12 FOR INFORMATION ON THE CONFERENCE, INCLUDING HOW TO REGISTER

REQUEST FOR INFORMATION ON MEDICAL GEOLOGY PROGRAMS
See back page.

Official inauguration of the Bolivian Chapter on Medical Geology held during the First Bolivian Symposium on Environment, Human Health and Medical Geology, La Paz, Bolivia, April 8-9, 2009.

Inside this issue:

MESSAGE FROM THE CHAIRMAN

Dear IMGA Friends and Colleagues:

It is with great pleasure that I introduce to you the first 2009 edition of the International Medical Geology Association (IMGA) bi-annual Newsletter. The overarching goal of our Newsletter is to highlight the newest developments in medical geology that are happening worldwide, demonstrating the benefits of medical geology to society.

As we begin our journey for 2009, I would like to highlight and share with you some of our most recent developments, additions and programs in which our membership has been actively involved.

1. In 2009, IMGA launched its Bolivian Chapter of Medical Geology, promoting a wide range of interactions and successful research programs in this region. Under the guidance of Prof. Dr. Jaime Rios Dalenz (a world recognized pathologist and elected President of the Bolivian Chapter of Medical Geology), the integration of health sciences and geosciences is beginning to merge as a promising field in the study of environmentally induced diseases in Bolivia and this region. To this end, we are delighted to receive the contribution from Prof. Dr. Gardon's research group demonstrating the importance of medical geology in addressing health issues in the Bolivian Amazonian region due to the use of mercury in low-scale gold mining. At IMGA, we want to build on this approach by facilitating new avenues for connecting medical geologists with each other, whatever their region, interest, and/or research project may be.

2. On the education front, we have many regional, national and international educational meetings and short courses that endeavour to build regional capabilities and opportunities for our young medical geologists. The IMGA Educational Committee, for example, under the direction of Bob Finkelman, has played a key role in fostering these developments and has provided the necessary infrastructure to facilitate a wide range of educational activities. I strongly believe that it will be through our education mission that IMGA will nurture an enduring legacy and provide a model for others to follow in the future.

3. Every two years we gather for a major international conference on medical geology (The Hemispheric Conference of Medical Geology) where we are kept up to date with an outstanding program, including the participation of IUGS commissions such as the IUGS Commission on Geoscience for Environmental Management (GEM). This year, our 3rd Hemispheric Conference on Medical Geology (3rd HCMedGeo) will be held in Montevideo, Uruguay the week of October 12-016, 2009, under the expert organization and direction of Prof. Dr. Nelly Manay. The program for this conference will have excellent keynote lectures, short courses, platform and poster presentations. There is no doubt that the 3rd HCMedGeo will be a major scientific and learning experience for all who attend – for our young trainees and for all of us who have been around for many years and are still learning. Please visit the conference website at http://www.geologiamedica.com to learn more about the conference.

With all these remarkable advances, we still have growing pains that we need to address. Among some of these is our need to stay updated with our membership fees. IMGA relies heavily on our members paying their fees, but unfortunately, I must say that this has been a real challenge to our Association. Our membership fees allow us to support students, publications, our website, short courses, Newsletter, CDs and many other benefits that we offer to our members worldwide. Without the proper level of funds we may have to scale down or to stop many of these services. I would like to take this opportunity to encourage everyone to stay up to date with your membership fees, and to consider other ways to support IMGA.

Please enjoy this edition of the Newsletter. As always, I am grateful to our Newsletter Editor, Dr. Dave Elliott, and all of you for making IMGA nothing short of a world class organization.

Jose A. Centeno
Chairman, IMGA

NEW MEDICAL GEOLOGY CHAPTERS

It is with great pleasure that the Directors and Officers of IMGA welcome two new Medical Geology Chapters

GERMANY

On behalf of IMGA Executive Committee, and our worldwide membership, we would like to formally welcome the German National Office of IMGA at the Friedrich-Schiller-Universitaet Jena. We congratulate you for your efforts in establishing this National Office. At IMGA, we are committed to support these initiatives, so please do not hesitate to contact us if you need any assistance concerning information, news and developments on Medical Geology.

BOLIVIA

It is with great pleasure that we welcome into our IMGA family our newest Chapter, the Bolivian Chapter on Medical Geology. The Bolivian Chapter was officially established on April 9, 2009 during the First Bolivian Symposium on "Environment, Health and Medical Geology" which was organized in La Paz, Bolivia under the auspices of the Bolivian Academy of Medicine and Socios para el Desarrallo (Pro- Salud) of Bolivia. (See photo on cover page). This Chapter is composed of over 25 members involving the participation of students and professionals from medical sciences, geosciences, and the environmental and public health communities and with representations from all over Bolivia. We congratulate the elected Board of Directors of the Bolivian Chapter for their commitment and efforts in establishing this Chapter, and moreover, for their willingness to serve as IMGA ambassadors.

The members of the Board of Directors for the Bolivian Chapter on Medical Geology are:

President: Dr. Jaime Rios Dalenz (Pathologist) Email: *jriosdal@hotmail.com*
Vice-President: Ing. Jose Luis Amarayo (Environmental Engineer) Email: *jlaramahyo@prosalud-socios.org.bo*
Secretariat: Dr. Rafael Cervantes Morant (Toxicologist) Email: *rcmqui@yahoo.com*
Treasurer: Dra. Jeanette Aguirre (Pathologist) Email: *aguirrej@hotmail.com*
Vocal: Lic. Rosario Tapia M. (clinician) Email: *charitotapia@hotmail.co*
Vocal: Dra. Flavia Barbieri (physician) Email: *flbarbieri@gmail.com*

At IMGA, we are all delighted with these developments and we would like to congratulate our colleagues in Bolivia for their vision and commitment to continue spreading the message of Medical Geology.

Welcome to the IMGA Family!

Jose A. Centeno, IMGA Chair
Olle Selinus, IMGA Co-Chair
Phillip Weinstein, IMGA Co-Chair
Robert Finkelman, Chair, IMGA Education Committee
Kimberley McAuley (formerly Chisholm), IMGA Secretariat
David Slaney, IMGA Treasurer
David Elliott, IMGA, Newsletter Editor

CHAPTER REPORT: EUROPE

Fiona Fordyce, British Geological Survey

EUROGEOSURVEYS AGRICULTURAL SOIL GEOCHEMISTRY MAPPING PROJECT

The EuroGeoSurveys Geochemistry Working Group has commenced the GEMAS-Project (Geochemical Mapping of Agricultural Land and Grazing Land Soils of Europe). 34 European Geological Survey Organisations will collect samples of arable land (ploughing layer, 0-20 cm) and of land under permanent grass cover (0-10 cm) at a density of 1 site per 2500 km^2 in their territory. The total area covered will be about 5.8 million km^2. The project is a continuation and extension of the Baltic Soil Survey (Reimann et al., 2003). The project is led by Dr Clemens Reimann, of the Norwegian Geological Survey who is Chair of the EuroGeoSurveys Geochemistry Working Group and Vice President of the International Association of Geochemistry (IAGC). The European metals industry, represented by EuroMetaux in Brussels, will contribute to this project over a period of four years.

Reimann, C., Siewers, U., Tarvainen, T., Bityukova, L., Eriksson, J., Gilucis, A., Gregorauskiene, V., Lukashev, V.K., Matinian, N.N., & Pasieczna, A. 2003. Agricultural Soils in Northern Europe: A Geochemical Atlas. Geologisches Jahrbuch, Sonderhefte, Reihe D, Heft SD 5, Schweizerbart'sche Verlagsbuchhandlung, Stuttgart, ISBN: 3-510-95906-X.

EUROGEOSURVEYS URBAN GEOCHEMISTRY

The EuroGeoSurveys Geochemistry Working Group on Urban Geochemistry lead by Dr Rolf Tore Ottesen of the Norwegian Geological Survey is producing a book on Urban Geochemical Mapping.

CONFERENCES AND WORKSHOPS

Numerous conferences and workshops were held across Europe in the last few months. Reports on conferences that have been held can be found on pages 7 to 11, and information on future events can be found on pages 12 to 17 of this newsletter.

CONTRIBUTIONS TO THE NEWSLETTER

Please send contributions to the newsletter to either:

Dr. David Elliott at *davide5@telus.net*
Dr. Olle Selinus at *olle.selinus@sgu.se* or *olle.selinus@gmail.com*

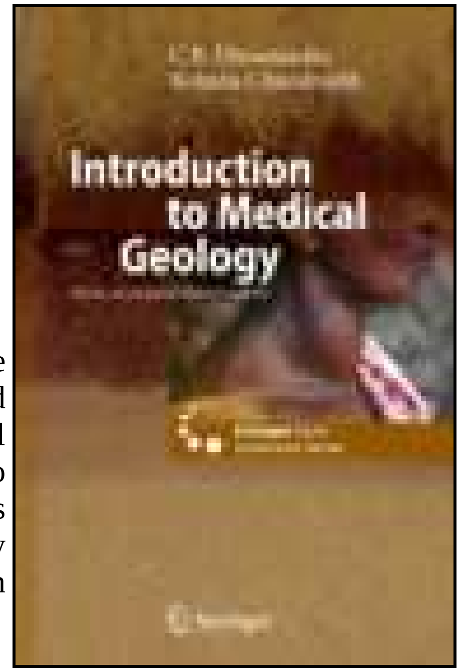
The deadline for submissions for the next newsletter is November 15th 2009 with publication planned in the following month.

See the back page of this newsletter for a summary of editorial policy.

NOTICES

INTRODUCTION TO MEDICAL GEOLOGY, Dissanayake, C.

A new book on medical geology is due in June, by our member Chandra Dissanayake,that concentrates on medical geology in tropical areas.



Introduction to Medical Geology
Series: Erlangen Earth Conference Series
Dissanayake, C.B., Chandrajith, Rohana
2009, XVI, 297 p. 166 illus., 50 in colour, Hardcover
ISBN: 978-3-642-00484-1

The book is due in June 2009 from Springer Verlag.

Over two billion people live in tropical lands. Most of them live in intimate contact with the immediate geological environment, obtaining their food and water directly from it. The unique geochemistry of these tropical environments have a marked influence on their health, giving rise to diseases that affect millions of people. The origin of these diseases is geologic as exemplified by dental and skeletal fluorosis, iodine deficiency disorders, trace element imbalances to name a few. This book serves as an excellent introduction to the emerging discipline of Medical Geology.

Contents

ENVIRONMENTAL HEALTH ENCYCLOPEDIA

Several IMGA members are contributing chapters to the Encyclopedia of Environmental Health, EEA, to be published by Elsevier. Previous issues of this newsletter contained information on the Encyclopedia, with a publication date in 2009 Publication is now scheduled for October 2010.

SANDRA LONDONO-ARIAS: RESEARCH ON TOPIC ANTIBACTERIAL MINERALS.

The School of Earth and Space Exploration at Arizona State University (Tempe, AZ, USA) is pleased to announce the acceptance of Sandra Londono-Arias (graduate of the Universidad Nacional de Colombia) into the Ph.D. program to work on the topic antibacterial minerals.

Sandra Londono, while a student at the Universidad Nacional de Colombia, helped organize a medical geology working group that has become an active Chapter of the IMGA. She has conducted research on the use of healing clays by indigenous people in the Amazon and she helped get formal recognition for medical geology by the Colombian government. Ms Londono was awarded the IMGA best student paper at the 2007 2nd Hemispheric Conference on Medical Geology held in Brazil. Sandra Londono's impressive activities in medical geology have been rewarded by acceptance into the Ph.D. program at Arizona State University.

Sandra Londono will work with Dr. Lynda Williams, Research Professor, who began investigating the antibacterial properties of clay minerals in 2003. Dr Williams' research focus on medicinal minerals began after meeting French philanthropist Line Brunet de Courssou, who had successfully treated patients suffering from Buruli ulcer (a mycobacterial skin infection) using clay. Photographic evidence of the healing process showed that skin infections were cured, and skin was regenerated over the wounds. Williams' research, funded by the National Institutes of Health, National Center for Complementary and Alternative Medicine, showed that certain 'healing clays' have antibacterial properties, while others do not. Clearly it would be advantageous for Society to learn from natural antibacterial minerals, the geochemical process that kills a broad spectrum of human pathogens, while allowing skin cells to regenerate. This is the overarching goal of the research that Sandra Londono will conduct with Dr. Williams.

Medicinal minerals research requires fundamental collaboration of specialists in mineralogy, geochemistry and microbiology (both environmental and clinical microbiology). This interdisciplinary approach to science is where new discoveries will be made. As a student, Sandra will learn basic methods for microbial testing and will work toward evaluating the geochemical conditions important to the antibacterial mechanism. This is a new frontier forged by a team of enthusiastic researchers at Arizona State University, the U.S. Geological Survey and collaborators at other Universities and Hospitals. We are just beginning down a long road of investigation with many discoveries to be made.

REPORTS ON CONFERENCES, WORKSHOPS AND MEETINGS

A HISTORICAL AND MEMORABLE WEEK OF MEDICAL GEOLOGY ACTIVITIES IN BOLIVIA (April 6-9-2009).

Under the auspices of the US-Agency for International Development (US-AID), Socios para el Desarrollo (Pro-Salud), and the Bolivian Academy of Medicine, medical geology was highlighted in several medical schools and universities in Bolivia during the week of April 6-9, 2009. Jose A. Centeno was the keynote speaker presenting lectures on medical geology and the International Year of Planet Earth at universities and medical schools in several Bolivian cities including Sucre, Potosi and Oruro. Jose's lectures were aimed at introducing Medical Geology to Bolivian universities, to students as well as environmental, and health professionals, emphasizing the significance of geosciences and public health/biomedical sciences to our planet and to our society. His lectures were attended by several hundred students, community leaders, local and regional government officials, as well as the local press. Several activities included reviewing environmental and public health research projects, and visiting sites among communities adversely impacted by natural and anthropogenic exposures affecting human health and environmental quality.

In Bolivia, an unprecedented opportunity exists to improve human well-being and accelerate progress towards sustainable development of medical geology practices towards protection of human health through the development and implementation of research projects. For example, in the city of Potosi, (a city with a history of uncontrolled mining practices) studies are being conducted by Dr. Rosario Tapia Montecinos et al (2008) to better understand and mitigate the impact that mining practices may have had on the health of adjacent communities. The interaction between toxicologists, epidemiologist, clinicians, geoscientists, and public health professionals have proven one more time to be a valuable tool in addressing these multidimensional problems. Similarly, in the city of Oruro, a region known for its widespread mining practice, studies are being conducted to better understand the impact that both natural and anthropogenic activities may have on the pediatric community (Barbieri F, 2009; in preparation).

Finally, the week culminated with an outstanding Symposium organized by the Bolivian Academy of Medicine and sponsored by USAID and ProSalud (Socios para el Desarrollo). The Symposium entitled Environmental, Human Health and Medical Geology was held on April 8-9, 2009 in La Paz, Bolivia. IMGA was represented by the Chair of our Education Committee, Bob Finkelman, and Jose. IMGA is proud of working together with our Bolivian colleagues and our newly established Bolivian Chapter on Medical Geology (BCMG) in facilitating and encouraging medical geology activities in Bolivia and in the region. The goal of IMGA, working together with BCMG, is to develop a strategy to further increase the appreciation of IMGA by environmental, biomedical, governmental and public communities as a contender among environmental and medical associations.

For additional information on the above listed projects and on the newly established Bolivian Chapter on Medical Geology, we encourage you to please contact:

Dr. Jaime Rios Dalenz (Pathologist), President BCMG; Email: *jriosdal@hotmail.com*
Lic. Rosario Tapia Montecinos . (clinician); Email: *charitotapia@hotmail.com*
Dr. Jacques Gardon (Physician, Epidemiologist); Email: *jacques.gardon@ird.fr*

Please enjoy this Newsletter and thank you for your support and participation on Medical Geology,

Jose A. Centeno, PhD, FRSC, Chairman, International Medical Geology Association; *tonycent@comcast.net*

See the cover page for a photo of the inauguration of the new Medical Geology Chapter in Bolivia

Jose A. Centeno visiting Cantumarca, a mining community in Potosi, Bolivia. The visit was organized by Dr. Rosario Tapia Montecinos (center) a member of the Bolivian Chapter on Medical Geology and principal investigator of an environmental and medical geology project aimed at studying the health impacts of mining activity in this community.

BRITISH GEOLOGICAL SURVEY MEDICAL GEOLOGY MEETING:
PRACTICAL APPLICATIONS OF MEDICAL GEOLOGY.

British Geological Survey, Keyworth, Nottingham, UK, 19-20th March 2009

The British Geological Survey (BGS) held a successful two-day Medical Geology meeting in March 2009. The meeting was supported by the International Medical Geology Association (IMGA) and the Society for Environmental Geochemistry and Health (SEGH), and brought together health and geoscience professionals working in the field of Medical Geology for the following presentations. Papers from the meeting will be published in a special issue of the Journal of Environmental Geochemistry and Health.

Continued on next page

Session 1: Bioaccessibility of harmful substances

Olle Selinus (Geological Survey of Sweden / Chair IMGA) – The international development of medical geology - what will happen now and in the future?

Sebastien Denys (INERIS) – In-vivo validation of the Unified Barge Method for the bioavailability of As, Cd and Pb in soils

Mark Cave (British Geological Survey) – Measurement Modelling and Mapping of the bioaccessibility of Arsenic in the Tamar Catchment

Christine Davidson (University of Strathclyde) - Human Bioaccessibility of Potentially Toxic Elements in Urban Soils from Two European Cities

Tom Van de Wiele (University of Ghent) – Development of an in-vitro test for measuring the Bioaccessibility of Polyaromatic Hydrocarbons in contaminated soils

Chris Collins (University of Reading) – Model human digestive system for the determination of bioaccessibility of environmental pollutants

Session 2: Biomonitoring

Randal Parrish (BGS/ Leicester University) - Environmental and military depleted uranium aerosol pollution: health and exposure assessment in light of recent UK and US studies

Raquel Duarte-Davidson (HPA) - An overview of human health risk and exposure assessment training needs across the EU

Mark Button (Leicester University / BGS) – Human toenails as a biomarker of exposure to elevated environmental arsenic

Jenny O'Reilly (Surrey University / BGS) – Biomonitoring / As speciation of human materials and environmental samples in As affected regions of Argentina

Paul Wright (ICENS, Jamaica) – Beta-2 Microglobulinuria in a Jamaican Population Exposed to Cadmium through Diet

Session 3: Hazard and Risk assessment

Paul Nathanail (University of Nottingham) – Bioaccessibility in human health risk assessment for regulatory purposes: Implications for the proposed Soil Framework Directive

Barry Smith (Intelliscience) – Risk assessment to technological materials: the importance of medical geology in crossing disciplines

David Polya (University of Manchester) – Groundwater Arsenic Attributable Health Risks in West Bengal- Application of Probabilistic Risk Assessment

David Large (University of Nottingham) – A Geological Re-evaluation of the Xuan Wei Lung Cancer Epidemic

Session 4: Deficiency / exposure health studies – impact on health

Andrew Hursthouse (University of the West of Scotland/ SEGH Chair) – Micronutrient Deficiency in Maternity and Child Health: exploring agricultural, medical and social influences on Fe and Zn deficiencies.

Charles Shand (MacAuley Institute) – Could exposure to silt adversely affect early life respiratory health?

Shona Kelly (Division of Epidemiology and Public Health, University of Nottingham) – Is environmental arsenic associated with increasing basal cell carcinoma incidence in Britain?

Session 5: Water, Air and Soil Quality

Mike Ellis (British Geological Survey) – Climate Change and its impact on Health

Alecos Demetriades (Institute of Geology and Mineral Exploration, Hellas) – Chemical speciation to assess bioaccessibility of potentially harmful elements in surface soil and house dust, Lavrion urban area, Attiki, Hellas

Nick Lloyd (Leicester University / BGS) – Environmental Fate of DU particulates after 25 years: implications for bioaccessibility

Clemens Reimann (Geological Survey of Norway) – EGG: European Groundwater Geochemistry Part I: Mineral Water

WSU (Walter Sisulu University) MAKES HISTORY AT 1st INTERNATIONAL CONFERENCE ON GEOPHAGIA

Staff from WSU recently participated in the lst International Conference on Human and Enzootic Geophagia in Southern Africa which took place at the Central University of Technology in Bloemfontein. It was organized by the research team on Human and Enzootic Geophagia in Southern Africa of which Prof. Ekosse, Director: Research Development, is the Project Leader. The conference was held from 23-25 October 2008. Prior to the conference, the 4th workshop of the Geophagia Research Group was held from the 19th- 22nd October 2008.

The Geophagia Research Group operates within the frame work of the UNESCO/IUGS/IGCP 545 Project on Clays and Clay Minerals in Africa, also led by Prof Ekosse. The Deputy Vice Chancellor: Academic Affairs and Research at WSU, Prof L. Obi, presented the 15th keynote paper on: *Microbiological and Allied Aspects Associated with Geophagia;* and the WHO country representative for South Africa, Dr. S. Anyangwe gave the 2nd keynote address on: *The Epidemiology of Geophagia in Humans.*

Geophagia, which is the deliberate and purposeful ingestion of soils and clays by human beings and animals, is known to be a form of pica and has been in existence for many years all over the world. It has been related to nutritional, psychological, cultural and medical, social, religious/spiritual, and ritual needs.

Prior to this project, there have been little, or no known, documented studies addressing the mineralogy, geochemistry, chemistry, microbiology, ecology, and human and environmental health associated with geophagia in Botswana, South Africa and Swaziland. Nutritional, pharmacological, and physiological effects on geophagic practitioners have not been adequately understood by the scientific community.

This 1st International Conference on Human and Enzootic Geophagia in Southern Africa provided a controlled and limited platform for researchers to share their findings on the subject. Conference presentations were on varied aspects of geophagia, particularly in the region, as well as other parts of the world covering the four conference themes:

- Historical, socio-cultural, and socio-economic aspects associated with geophagia
- Physico-chemistry, chemistry and mineralogy of geophagic materials
- Human and animal health aspects associated with geophagia
- Geophagia and the biophysical environment

Other WSU staff who attended inciuded the Dean of the Faculty of Science, Engineering and Technology, Prof. S. P. Songca; Prof. N. D. Jumbam of Dept. of Chemistry and Chemical Technology; Prof. G. George, Dept of Medical Biochemistry of the Faulty of Health Sciences; Dr. P. Phoofolo of the Dept. of History; Dr. B. Nkeh-Chungag of the Department of Physiology; Ms. S. Nkanyazu of the Department of Psychology; and Ms M. Bisi-Johnson of the Department of Medical Microbiology. Conference participants came from many African, American, and European countries, including Botswana, Swaziland, Nigeria, and the USA.

There were several presentations from WSU staff. Dr. Phoofolo's presentation titled, *"Rooted to the Soil: Earth-eating as a Social and Cultural Practice among the BaSothd"* was commended for academic excellence and originality. Ms. Nkanyazu won the prize for best presentation from colleagues who do not constitute the Geophagia Research Group. Her presentation was on: *Soci-geophagical Trends of Pregnant Women in the Rural Areas of Eastern Cape, South Africa.*

I[st] INTERNATIONAL CONFERENCE ON HUMAN AND ENZOOTIC GEOPHAGIA

From the left: Prof. B. Frey, Executive Dean of the Faculty of Health and Environmental Sciences, Central University of Technology, Bloemfontein; Prof. L. Obi, Deputy Vice-Chancellor, Academic Affairs and Reserarch, WSU; Dr. S. Anyagwe, World Health Organisation Country Representative for South Africa, and Prof. G. Ekosse, Director of Research Development, WSU.

From the left: Prof. G. Ekosse, Director of Researh Development, WSU; Dr. S. Anyangwe, World Health Organisation Country Representative for South Africa; Mr. Teboho Loate, Chairperson of Council of Central University of Technology; Prof. L. De Jager, director of the School of Health Technology at Central University of Technology, and Prof. L. Lategan, Dean of Research and Development at the Central University of Technology

Dear Colleagues,

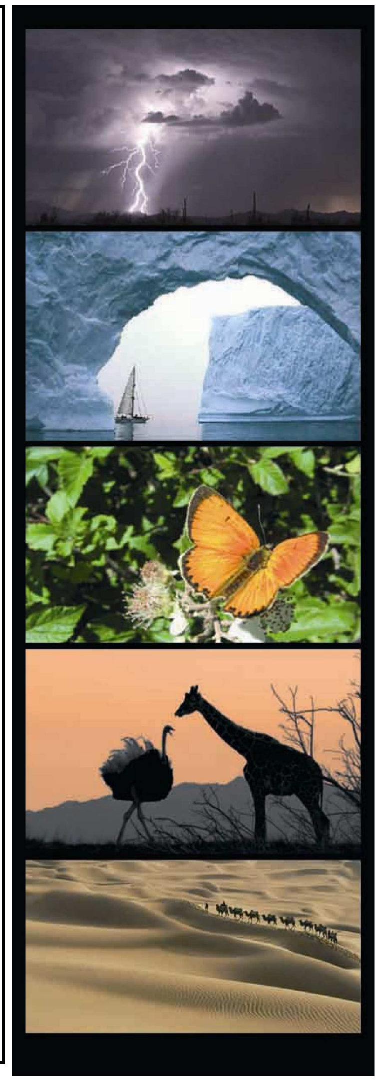
We are pleased to inform you about the upcoming 3rd Hemispheric Conference on Medical Geology, which will take place in Montevideo, Uruguay, on October 12 to 16th, 2009.

For further information, we invite you to visit the 3rd HCMedGeol website at *www.geologiamedica.com*.

Organizing Committee, 3rdHCMedGeo

Con motivo de un nuevo aniversario del Día del Planeta Tierra -22 de Abril- y de la Tercera Conferencia Hemisférica sobre Geología Médica (3rd. HCMed.Geo) a realizarse en octubre en nuestro país, Easy Planners se interesó por conocer un poco más acerca de esta disciplina que gradualmente gana la atención de profesionales, autoridades y público en general

La Geología Médica se define como la ciencia que trata sobre la relación entre los factores geológicos naturales y la salud humana y animal, entendiendo la influencia de factores ambientales ordinarios en la distribución geográfica de tales problemas de la salud. La Geología Médica es por consiguiente una disciplina amplia y compleja que requiere contribuciones interdisciplinarias de diferentes actores científicos como geólogos, ecólogos, químicos, biólogos, científicos profesionales y ambientales, médicos, veterinarios, toxicólogos, epidemiólogos, patólogos y cualquier otro profesional de la salud, ambiente y de las geociencias. Mediante un abordaje Geomédico, es posible superponer los datos geoquímicos con datos epidemiológicos que permitan identificar los riesgos de una población a desarrollar algún tipo particular de enfermedad asociada y así apoyar al diagnóstico, prevención y remediación en pos de una mejor calidad vida en el planeta.



No es cuento chino

Uno de los registros más antiguos de la Geología Médica fue proporcionado por Marco Polo, quien en 1271 partió hacia China desde Venecia junto con su padre y un tío. En 1275 llegaron a la residencia de verano del Kublai Kan. Marco Polo por entonces era empleado del emperador y trabajó como su emisario, e incluso fue por un tiempo gobernador de una parte de China. "Al final de diez días llegó a una provincia llamada Su-chau. Los viajeros que pasaban por esta vía no se aventuraban a ir por entre las montañacon cualquier bestia excepto con las nativas, porque allí crece una hierba venenosa que hace perder los cascos a las bestias que se alimentaban con ella; perolas bestias nativas reconocían esta hierba y la evitaban...".

Marco Polo informó así que sólo podía usar caballos locales en las áreas montañosas de China, y no sus caballos europeos. Los caballos importados se murieron porque no pudieron evitar comer estas plantas venenosas y él también describió los síntomas. Nunca se enteró, obviamente, que sus informes eran de origen geomédico. Sin embargo, ahora sabemos que las áreas que él describió guardan contenidos naturales altos en selenio y los síntomas de la enfermedad muestran que los animales afectados resultan envenenados con dicha sustancia.

1. Marco Polo
2. *La caravana de Marco Polo viaja hacia las Indias* (Autor desconocido -1375)

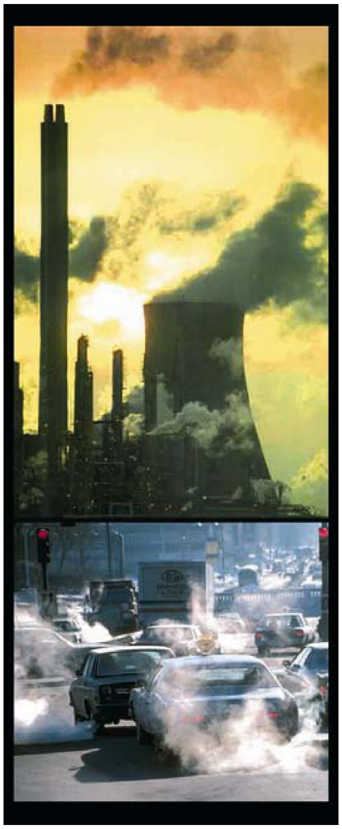
El caso del plomo

En la década de 1960 el plomo fue reconocido como uno de los metales más venenosos de la industria y se demostró que su contenido en aire, agua y polvo producía perjuicios a los niños. Los países avanzados muy pronto prohibieron su uso en pinturas, latas y combustibles.

En nuestro país el tema alcanzó estado público recién a principios de este siglo, cuando se comprobaron varios casos de contaminación de niños con plomo ambiental en el barrio capitalino de La Teja. Encendida la alarma, muchos otros casos en diversos puntos de Montevideo y el país vieron luz, instalando definitivamente la problemática en la sociedad.

La exposición al plomo que contamina el ambiente, afecta el sistema nervioso del niño, alterando sus facultades cognitivas y de aprendizaje. Dificultades motrices, anemia, problemas de conducta, dolores abdominales, fatiga muscular y hasta problemas en la coordinación visual-espacial son también consecuencias posibles de esta exposición.

UPCOMING CONFERENCES, WORKSHOPS AND MEETINGS Cont.



La contaminación por plomo y su repercusión en la población uruguaya ha sido considerado como un caso de gran interés científico a nivel internacional, por su abordaje multidisciplinario, interinstitucional y de inclusión social. El actual Director y fundador de la Asociación Internacional de Geología Médica, Dr. José Centeno (IMGA - Internacional), ha reiterado la importancia de este ejemplo en Geología Médica por la interacción y trabajo conjunto de múltiples disciplinas, para dar solución a una problemática que vincula aspectos geológicos, ambientales, sanitarios y sociales.
La Profesora Dra. Nelly Mañay (IMGA - Facultad de Química) con su equipo, han liderado la promoción y difusión de la Geología Médica en Uruguay desde 2003, y han tomado el desafío de la organización de la próxima 3ª Conferencia Hemisférica de Geología Médica en Montevideo.

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2009 INTERNATIONAL SYMPOSIUM ON ENDEMIC DISEASES AND GEOLOGICAL ENVIRONMENT

Changchun City, Jilin Province, China, August 10-14, 2009.

INTRODUCTION

Areas where people suffer seriously from endemic arsenic poisoning, fluorosis or Kashin-Beck disease have been increasingly attracting attention. In order to address such endemic problems, the 2009 International Symposium on Endemic Diseases and Geological Environment (ISEDGE) will be held in Changchun city, Jilin Province, China, August 10-14, 2009. The purpose of the conference is to provide a platform for scientists and researchers in medical geology, environmental geochemistry, environmental health sciences, and endemic diseases to communicate the latest developments in related fields in geological environment and health, and to reinforce the existing cooperation among the professionals in environmental geology and endemic medicine. The conference is sponsored by CGS, UNICEF, IUGS-GEM, IAH, NSFC, Jilin Provincial Department of Land and Resources, and Jilin Province Bureau of Geology and Mineral Exploration.

We sincerely invite you to participate in, and contribute papers to, this important conference. Topics will encompass the whole breadth of medical geology, environmental geochemistry, environmental health sciences and endemic medicine.

Continued on next page

PROPOSED PROGRAM TOPICS

- Medical Geology
- Environmental Geochemistry and Disease
- Geological Environment and Human Health
- Arsenic and fluorine pollution and human health
- Arsenic and its transfer pathways in the environment
- Fluorine and its transfer pathways in the environment
- Iodine and its biogeochemical cycle and Iodine Deficiency Disorder
- Distribution, formation and geo-environmental conditions of Kashin-Beck Disease
- Prevention and Control of Endemic Diseases
- Remediation techniques for arsenic and fluorine from water in Endemic Disease Areas
- Techniques and Methods of Groundwater Exploration in Endemic Disease Areas

SPONSORS

China Geological Survey (CGS)
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International Association of Hydrogeologists (IAH China Chapter)
Department of Earth Sciences of National Natural Science Foundation of China (NSFC)
Jilin Province Department of Land and Resources
Jilin Province Bureau of Geology and Mineral Exploration

ORGANIZERS

Center for Hydrogeology and Environmental Geology, CGS (CHEG)
General Station of Geologic Environmental Monitoring of Jilin Province

LANGUAGE

English, Chinese.

ACADEMIC AND SOCIAL CONTENTS OF THE CONFERENCE

The 2009 ISEDGE will include speeches by invited keynote speakers, oral presentations of authors, poster sessions and a post-session technical excursion.
The tentative technical program is:

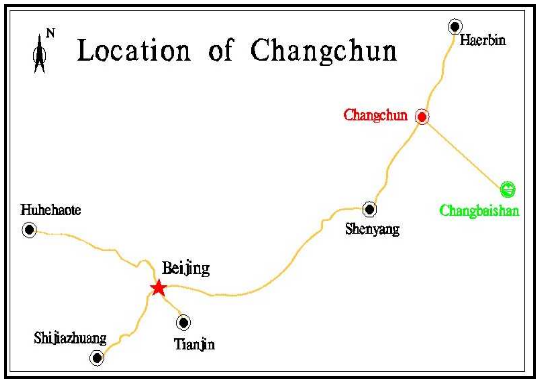
Sunday, August 9, 2009
8:00 am-6:00 pm Registrations

Monday, August 10, 2009 - Wednesday, August 12, 2009
8:30 am-5:30 pm Daily plenary

Thursday, August 13, 2009 - Friday, August 14, 2009
Technical Excursion

TECHNICAL EXCURSION

The symposium plans a post-session technical excursion into the Changbai Mountain. Changbai Mountain is located in the counties of Antu, Wusong and Changbai in southern Jilin Province, which is one of China's Natural Preserves, covering over 200,000 hectares, extending 78.5 kilometers from the north to the south, and 53.3 kilometers from the west to the east. It has preserved a wholesome environment and ecosystem for world famous rare animals, such as Amur tigers (also known as the Siberian), sikas, and sables.
You will visit the Crater Lake known as “The Heavenly Lake”, waterfall, hot springs and primeval forest, in the excursion.



All the accepted papers will be published as the symposium proceedings.

Registration Fees

Category	Early Registration Before June15, 2009	Late Registration June 15 - August 14, 2009
Participant	150 US$/80 Euro	200 US$/100 Euro
Student	80 US$/40 Euro	100 US$/50 Euro
Accompnying Person	80 US$/40 Euro	100 US$/50 Euro
Technical Excursion	2 day trip 13 - 14 August 2009: 100 US$/50 Euro	

How to pay the fees will be found in the SECOND CIRCULAR or on the symposium website soon.

CONTACT

Dr. Zhang Eryong
China Geological Survey
45 Fuwai Dajie, Xicheng District,
Beijing 100037, P.R.China
Tel: +86-10-58584556, +86-13031093865
Fax: +86-10-58584556
E-mail: *ffs@cgs.gov.cn*

21ST CONFERENCE OF THE INTERNATIONAL SOCIETY FOR ENVIRONMENTAL EPIDEMIOLOGY (ISEE): FOOD AND GLOBAL HEALTH.
Dublin, Ireland, 25-28 August 2009

The Society for Environmental Geochemistry and Health (SEGH) will hold a session at this conference. More information is available on the web-site:
http://www.iseepi.org/conferences/future.html

Contact: Anthony Staines, School of Nursing, Dublin City University, Dublin, Ireland *anthony.staines@dcu.ie*

INTERNATIONAL SYMPOSIUM ON MINERALOGY, ENVIRONMENT AND HEALTH,

Université Paris-Est Marne la vallée, France, 17 - 18 September 2009
This symposium will focus on the following topics:

Topic 1 : Nanoparticles, environment and health

Topic 2 : Environmental Health: Sources of Exposure and Health Effects of Trace Elements, Toxic Metal Ions, Metalloids
Topic 3 : Mineral Dusts and Human Health
Topic 4 : Soil–plant transfer: effect of soil mineralogy
Topic 5 : Environmental Toxicology, Geochemical Studies and Health Effects
More information is available on the web-site: *http://www.univ-mlv.fr/master_geoenv/symposium2009.html*

GEOLOGICAL SOCIETY OF LONDON WILLIAM SMITH MEETING 2009: ENVIRONMENT, POLLUTION & HUMAN HEALTH
The Geological Society of London, Burlington House, London 21–23 September 2009

This conference aims to bring together "traditional" geoscientists (geochemists, hydrogeologists, engineers, geophysicists, mineralogists) and scientists outside traditional earth sciences (toxicologists, microbiologists, physicists, chemists) from both academic and industrial communities to present and discuss the state-of-the-art in the understanding of environmental pollution and the potential threats to human health. More information is available on the web-site:

http://www.geolsoc.org.uk/gsl/events/listings/page4598.html

27TH EUROPEAN CONFERENCE AND WORKSHOPS OF THE SOCIETY FOR ENVIRONMENTAL GEOCHEMISTRY AND HEALTH (SEGH): ENVIRONMENTAL QUALITY AND HUMAN HEALTH - HARMONY BETWEEN MAN AND EARTH
Galway, Ireland, June 27-July 2 2010

This conference is co-organized by National University of Ireland, Galway (NUI Galway), Environmental Change Institute (ECI) and Health Service Executive (HSE) West, Ireland. The International Medical Geology Association (IMGA) will hold a workshop at this conference. More information is available on the web-site: *http://www.nuigalway.ie/segh2010/*

URBAN AREAS AND HEALTH – A FUTURE AREA FOR MEDICAL GEOLOGY.

Olle Selinus

ABBREVIATIONS USED:

IUGS	International Union of Geological Sciences
IUSS	International Union of Soil Sciences
IUFoST	International Union of Food Science and Technology
IGU	International Geographical Union
IUGG	International Union of Geodesy and Geophysics
ISPRS	International Society for Photogrammetry and Remote Sensing
ICSU	International Council for Science
ICSU-ROA	ICSU Regional Office for Africa
SHWB	Science for Health and Wellbeing
JSPT	Joint Science Program Team
IYPE	International Year of Planet Earth
IIASA	International Institute for Applied Systems Analysis

INTRODUCTION

I will describe here the background, development, and the plans for a promising development for the future. This initiative has developed these last few years and started as two different tracks which have now merged into one, with important players and organisations at a high level. This also shows the importance of health issues on a broad scale, embracing several disciplines and organisations, and where IMGA plays an important role for the future. It started in 2004:

Track 1. GEOUNIONS.

The Presidents and Secretaries General of IGU, IUGG, IUGS and IUSS, decided, at a meeting held in Paris on February, 2004, to launch a joint scientific program. Five topics were selected for the joint science program: desertification, groundwater, hazards, health (medical geology), mega-cities (and cities in general). IUGS became the responsible union for health. Later on ISPRS was included.

In 2004 the ICSU GeoUnions (IGU, IUGG, IUGS, IUSS, and ISPRS) created *a Joint Science Program Team (JSPT)*, for health of leaders appointed by the Unions and supported by groups in the Unions.

Geoscience and health (medical geology and medical geography) is a responsibility of all the geounions: **IUGS** took an initiative when it established a working group on medical geology in 1996; by 2006 it evolved into IMGA. The **IGU**, through its commissions dealing with health and the environment, and its national member organizations, has supported research in medical geography since the 1960s. More recently, through the International Symposium in Medical Geography, the ICSU and IHDP sponsored inter-disciplinary projects, Setting an Agenda for Research on Health and the Environment and Health and the Environment - a Crosscutting Issue in Global Change Research, medical geographers have argued for a broad approach to research on health and the environment including health and the geosciences. **IUGG** has an interest in problems related to natural radiation, radon, and other aspects of the natural environment. For example, soil is the main source of elements and nutrients in agriculture, therefore **IUSS**, dealing with soils, is involved in the links between soils-agriculture and health effects, the health effects of global dusts, geophagia, etc, just to mention a few aspects, are also of importance to IUSS. **ISPRS** is also involved in this through, for example, diseases caused by atmospheric dust. They have developed models for use within the health sciences.

At a meeting of the IGU, ISPRS, IUGS, IUSS, and IUGG in Boulder, Colorado in September 2004, Olle Selinus was appointed responsible for the health team and in September 2005 representatives of the five unions met in Uppsala, Sweden, to discuss strategies, workplans etc., for the joint health efforts of the unions. The representatives were: Olle Selinus (IUGS), Amy Budge (ISPRS), Eiliv Steinnes (IUSS), Mark Rosenberg (IGU) and Claire Horwell (IUGG).

After a 3 day meeting we decided on short-term goals: to make members of the 5 unions aware of the interdisciplinary initiative on health, promote collaborative efforts in education and research among union members and develop a series of activities in preparation for IYPE.

Longer-term goals were also established: involving the health professions in the GeoUnions health initiative, initiating a series of crosscutting activities with the other GeoUnion joint science program teams and involving other ICSU member organizations in the GeoUnions health initiative.

However after returning to the executives of the GeoUnions we found that there was not enough interest and, our efforts were directed to another track which had started almost simultaneously, and this showed to be more attractive. This track was SHWB:

Track 2 SHWB

The background of this was spontaneous discussions 2003 among bio-related unions under ICSU which resulted in a decision to pursue an initiative on Science for Health and Well Being (SHWB). The Science for Health and Well-Being Initiative (SHWB) seeks to improve and advance human health and well-being. It will marshal expertise from the natural, social, behavioral and engineering sciences into a coordinated program designed to attain new insights into research and policies that affect the health and well-being of people. SHWB will organize programs and projects that transcend scientific boundaries, and are most effectively pursued by multidisciplinary teams, including teaching and research units to explore the real life problems of various communities. SHWB will build upon existing synergies among international scientific organizations affiliated with the International Council for Science (ICSU) and seek to foster new synergies among them.

Draft mission statement, goals for the program and recommendations to ICSU were then put together. In 2004 in Paris, proposals for various initiatives and the need for cross-union collaboration were discussed. It was realised that a focus on global challenges required the participation of multiple unions, and in January 2005, a proposal to ICSU was prepared and approved by ICSU in June 2005. Following that, in 2006, the SHWB Executive Committee and Steering Committee were established.

Until now, ICSU has not been a major player in international health research, but this has changed and health is stressed in the new strategy of ICSU. There is a wealth of expertise within the ICSU family on various aspects of health research, which needs to be more fully incorporated into ICSU's existing activities. There is also a need for new partnerships with the clinical research community. ICSU therefore is

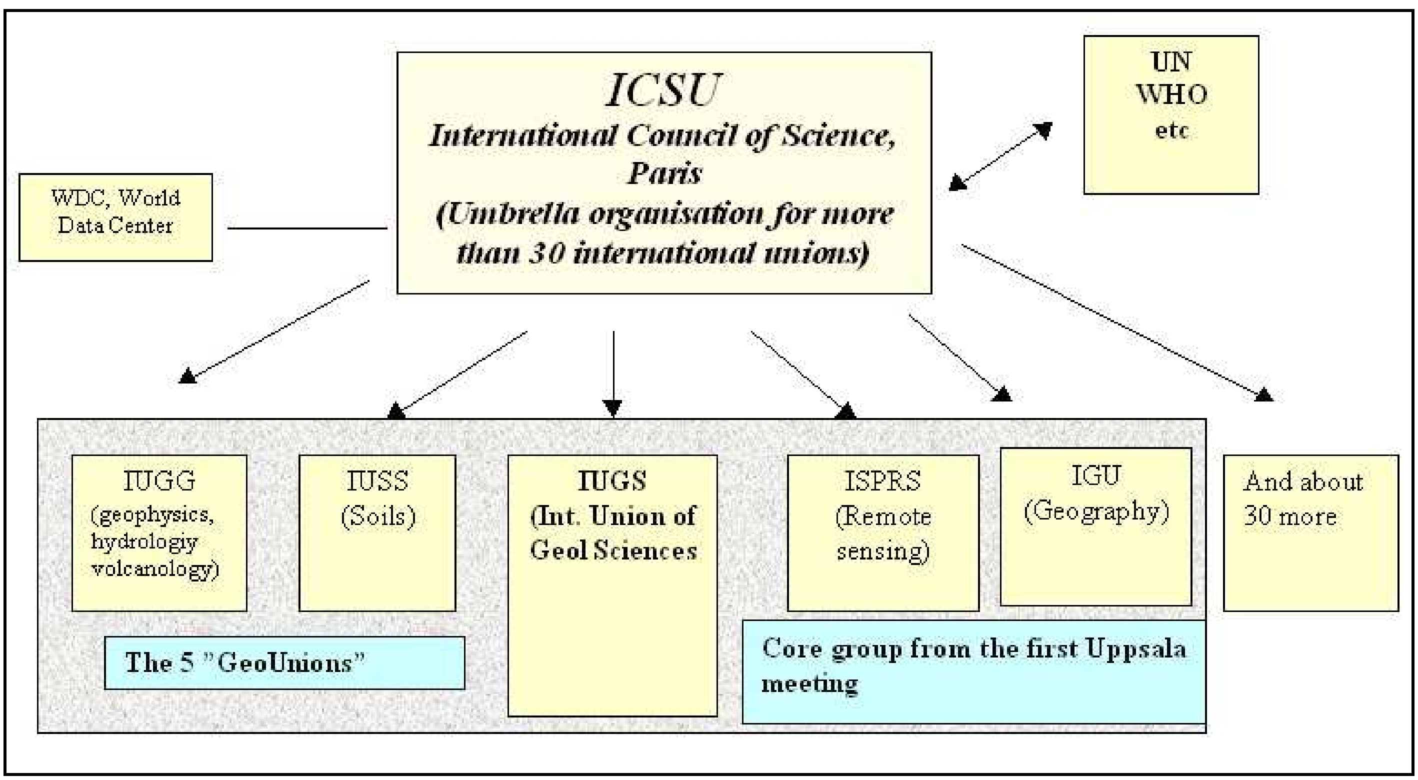


Figure 1. Organisation of ICSU and the GeoUnions

assisting with the development of a new research initiative with a major focus on human health: Science for Health and Well-being, bringing together the perspectives of many ICSU Unions, which is a uniquely integrated approach to human health.

LINKING GEOUNIONS AND SHWB

In 2006-7 contacts were made between GeoUnions and SHWB under ICSU for linking these initiatives. In January 2008 a big meeting was organised by ICSU at IIASA in Laxenburg in Austria. Participants in this meeting came from the GeoUnions, several other unions, ICSU, WHO, United Nations and other organisations. Olle Selinus represented IUGS and IMGA at this meeting together with Amy Budge and Stan Morain from ISPRS also representing GeoUnions.

Many presentations were given and panel discussions were carried out addressing urban areas and health. Given the pace at which the world is urbanizing, problems across a broad range will be increasingly urban problems. Among the main issues identified were indoor air pollution caused by use of solid fuels, CO2 emissions tied to power generation, and urban air pollution tied to the rise of automobiles and other forms of motorized transport. Links between urbanization, geology, natural catastrophes, and health were described. Meteorological disasters (e.g., floods, hurricanes), and geological disasters (e.g., earthquakes, mudslides, tsunamis) cause the greatest damage. It is generally the poor who are ill-equipped to prevent or mitigate losses and, who, after disaster occurs, experience greatest difficulty in recovering. A systems approach would take into account the multiplicity of hazards, different levels of population vulnerability, and the need for an integrated, inter-sectoral policy approach.

ICSU stressed the importance of Africa. Experience in urban Africa is quite different from that in more developed countries. In Africa, families lose traditional rural support systems when they move to an urban environment, they also become prone to “diseases of affluence”, largely dietary in origin. Also, many chronic conditions are related to age, not other risk factors; for example, while high cholesterol may raise risks of cardiovascular problems in persons in their 50s or 60s, by the time they are into their 70s or 80s, it ceases to be significant. The findings of the ICSU scoping group for SHWB led to a preliminary conceptual framework for a systems analysis approach to urbanization, health, and well-being.

2008 ICSU GRANT PROJECT

After the workshop in Laxenburg, an application was submitted to ICSU from the GeoUnions, which had asked us to submit this proposal, and the project's strategic objective was to add geoscience content to the SHWB framework. The vehicle for this was to integrate expertise from the GeoUnions' *Joint Science Program Team* for health with the ICSU-SHWB and ICSU ROA collaborators to evolve an advanced version of the framework. ICSU's Grant Programme was an excellent opportunity to refine the framework in a bottom-up fashion. The *purpose* was to develop health-oriented geoscience research questions to guide future externally funded research by national and international bodies. Project Coordinator was Stan Morain, ISPRS.

Operational objectives included: (a) a 3-day workshop in Africa to ensure the core science team's understanding of the systems analysis approach and to emphasize the need to address regional health policy and decision-making needs; (b) a writing phase for the core team and African collaborators to review their science content at the boundary between the physical Earth and the living planet in the context of sustainable human health and research needed to address identified science and policy needs; and (c), an international conference aimed at vetting the report before it is submitted to ICSU.

WORKSHOP IN SOUTH AFRICA, January 2009

The JSPT for health and environment met jointly with ICSU, ICSU-ROA collaborators and representatives from the International Union of Food Science and Technology (IUFoST) in South Africa in January 2009. The goals were to: (a) develop an appreciation for the SHWB systems approach and conceptual framework; (b) understand the roles of each participating Union in SHWB; (c) learn about African perspectives and issues regarding SHWB; (d) review the health status of sub-Saharan cities; and, (e) create a blueprint for each Union's response to the conceptual framework. The guiding philosophy was that GeoUnions contribute to SHWB at the interface between cultural, physical, and geophysical histories of land surfaces; and, that these in turn underpin biological and chemical processes that govern health, environmental health, and ecosystem functions.

The 2009 workshop achieved its goals. As a mechanism for distilling a vast array of relevant information we adopted a matrix approach to identify currently available Earth science models, and modeling systems which will be useful in human health monitoring and decision making at local, national, and regional scales. Another matrix was created for collecting information about health and well-being issues faced by cities in sub-Saharan Africa. A subcommittee of regional experts from West, East, and Southern Africa was formed at the 2009 workshop. One of the experts was IMGA member, Theo Davies.

WHAT NEXT?

During 2009 we have collected global information on cities and health, which models are used etc. The African subcommittee has gathered information on African cities. A follow up meeting was held in Italy in May 2009 at the 33 International Symposium on Remote Sensing of Environment, also with a special session on cities and health. During this summer we will put together an extensive report to ICSU with matrices on models and methods used and how to proceed. This report will be submitted in September, also suggesting African cities to use for pilot studies. Then this will hopefully be positively considered by ICSU, and then these suggestions will be used as the main basis for planning a future 20 year ICSU program on cities and health on a global scale, also, of course, including the medical profession.

This is an excellent example of how important health aspects and medical geology will be in the future, in this specific case in cities. It is also a good example of collaboration between different disciplines. IMGA has a role in this and is on the train going into the future.

Figure 2. Participants in the workshop in South Africa January 2009.
From left to right: Achuo Enow (ICSU-ROA), Ania Maria Grobicki (WHO, IUGG), Theo Davies (IMGA), Agnes L. Kijazi (ESSP), Mark Rosenberg (IGU), Olle Selinus (IUGS, IMGA), Amy Budge (ISPRS), Eiliv Steinnes (IUSS), Dov Jaron (ICSU), Stan Morain (ISPRS), Margaret Avery (INQUA), Sospeter Muhongo (ICSU-ROA).

GEOMEDICAL ENGINEERING: A NEW AND CAPTIVATING PROSPECT

Atteeq Ur Rehman, Quarry Planner & Researcher, Pakistan Cement Company Limited.
(A company of Lafarge Cement Group) atteequr@yahoo.com

ABSTRACT

Geomedical engineering will prove to be an emerging fielding in dealing with human interaction with geo-environments, and how to prevent adverse impacts on public health. Some naturally occurring elements are extremely dangerous for human health when ingested to excess. The aim of studies in geomedical engineering is to pinpoint the poisonous contents of natural environments to cope with forthcoming health-dangers and uncertainties. In addition, geomedical engineering would provide supportive techniques to deal with geological threats and to prevent its impacts on human and animal health. A significant need for it has been greatly realized, due to the rapid growth in population and the advent of environmental concerns. There is a dire need to get an augmented awareness of this issue among scientists, engineers, medical specialists, and the general public as well. This paper proposes the introduction of new branch of engineering i.e., "Geomedical Engineering".

INTRODUCTION

Medical Geology is a relatively new sub-discipline in the Earth Sciences. Interest in this field is growing rapidly due to its significance to human health. Unfortunately in Pakistan it has not yet been acknowledged. There is an immense need to raise its understanding among researchers and the general public. One way this can be accomplished is by concerned experts submitting contributions to journals and newspapers. Moreover, universities should include Medical Geology in the courses of Geology and Medical Sciences, as many developed countries of the world are already doing.

Many areas of the world are suffering from diseases caused by the deficiency or excess of certain elements in rocks, minerals and soils. For example, arsenic poisoning is the biggest environmental disaster in modern times, affecting millions of people in West Bengal and Bangladesh. This terrible environmental health problem has its origin in the geology and mineralogy of the sediments of the deltaic plains.

Clearly, there is much potential for geoscientists to make meaningful contributions to help to minimize or prevent these types of environmental health problems. This paper proposes the new and useful concept of *Geomedical Engineering*. It can be defined as *"Geomedical engineering deals with the principles and techniques of engineering to prevent or reduce the impacts of geological, geochemical and geoenvironmental factors on human and animal health"*.

CORE IDEAS OF GEOMEDICAL ENGINEERING

Geomedical Engineering would establish apply engineering and geological solutions to health hazards originated by geological and geo-environmental factors. Geomedical Engineering would include:

- **Hazard Evaluation and Quantification:** To evaluate the geometry and extent of the hazardous zones and earth processes injurious to human health. Establishing the relationship of diseases to the deficiencies or excess of certain elements.
- **Water treatment and improvement**: By addition and reduction of certain elements and substances.
- **Up-grading Earth Materials:** Development and application of techniques to identify and improve the deficiencies of certain elements in soil and rock or groundwater.
- **Reclamation of Earth Materials:** Development and application of techniques to identify and rectify the excess of toxic elements in soil and rock or groundwater.

WHAT WOULD BE THE ROLE OF A GEOMEDICAL ENGINEER?

A Geomedical Engineer would prepare the maps indicating the extent and toxicity of deleterious elements in earth materials and waters. He would mark the hazardous areas and those likely to be hazardous, in consultation with biomedical/public health scientists. He would implement reclamation techniques by artificial addition of certain minerals or salts to the materials and water, after consultation with medical specialists. He would also implement techniques to stop the artificial addition of toxic substances from external sources. He would design certain water and soil treatment programs to control toxicity risks. He would support society by promoting the sustainable usage of natural resources and help to create a balance between man and the environment.

How does Geomedical Engineering differ from Medical Geology?

Medical Geology examines the role of rocks, soils, and groundwater in controlling the health of humans and animals, and considers the influence of the environment on the geographical distribution of health problems. Planet earth is the ultimate source of all metals. These metals are inhomogeneously distributed and occur in different chemical forms. Drinking water travels through the rocks and soils as a part of hydrological cycle.

Thus, Medical Geology:

- Identifies and characterizes the natural sources of harmful materials in the environment.
- Predicts the movement and alteration of chemical and other decease-causing agents over time and space.
- Provides an understanding of how people are exposed to harmful earth materials and that what can be done to put a stop to such exposure.

Whereas, Geomedical Engineering:

- Provides the engineering solutions and techniques to Medical Geologists for hazard identification and quantification.
- Introduces and develops techniques for rock, soil and water treatment and rectification of certain diseases.
- Develops supportive techniques to improve the deficiency and control the toxicity of certain elements in natural environments.

On the whole, Geomedical Engineering would concentrate the engineering principles and techniques for reclamation of certain Medical Geology issues.

Predicting the Future

As a branch of engineering, with the advent and improvement in analytical techniques and parameters, Geomedical Engineering is expected to have many interesting and successful applications, especially in developing countries. However, it would be necessary to raise the funds for Geomedical Engineering research in these countries. Developing countries are usually more interested in those fields and research activities which provide them money and resources for their existence. Geomedical Engineering would be highly valuable and beneficial in terms of human health and sustainable social development.

It is expected that after a short time Geomedical Engineering will grow as quickly as Medical Geology is. Geoscientists will dominate the field but there will be greater networking and collaborations with the public health and biomedical scientists. Finally government agencies, universities and environmental agencies will begin to hire Geomedical Engineers.

Conclusions

Geomedical Engineering will be highly advantageous for mankind. It will help to reduce the probability of diseases by removing or correcting their root causes. Geomedical Engineering identifies the geological factors causing diseases and also provides the supportive engineering techniques to remove those causes. Geomedical Engineers will work side by side with Medical Geologists. It will be an interdisciplinary field having close interaction with geology, medical sciences and environmental sciences.

References

Finkelman R., Centeno J., Selinus O. 2005. Medical Geology: the emergence of a new discipline. Terrae, 2(1-2):3-8.

Selinus O. 2004. Medical Geology: an emerging specialty. Terrae, 1(1):8-15. <http://www.ige. unicamp.br/terrae/>

Dissanayake C.B. 2004. Medical Geology: a fascinating new science. HUMBOLDT kosmos 84/2004.

Keller E.A. 1988. Environmental Geology. Merill Publishing Company: A Bell & Howell Information Company, 5th ed., 323-329

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MERCURY EXPOSURE IN THE BOLIVIAN AMAZON

Flavia L Barbieri; Pamela N Paco; Jacques Gardon

Several studies have demonstrated the presence of mercury compounds in the Amazonian basin. This contamination has a complex origin, both natural and anthropogenic. Amazonian soils are old and naturally rich in iron oxy-hydroxides and have accumulated large amounts of mercury. Nevertheless, anthropogenic activities developed during the last century have increased mercury concentrations. Erosion of deforested soils following human colonization constitutes an important mobilization of mercury sources, and in some regions the retorting of amalgam to separate gold from mercury intensifies this contamination. In the aquatic environment, in the presence of sulfate-reducing bacteria, inorganic mercury is transformed into methylmercury and incorporated into the food chains, where it undergoes a process of bioaccumulation and biomagnification along the trophic levels. Therefore, the riverside populations who depend on fish as source of nutrients are the most exposed to this toxic. This situation has been widely documented since the early nineties, especially in Brazil and French Guyana.

Since the Minamata industrial accident, methylmercury is known to be neurotoxic, especially from *in utero* exposure. In a series of birth cohort studies from the Faroe Islands with low exposure levels, subtle neurological effects have been observed years after birth, in children whose mothers were exposed to methylmercury through marine mammal consumption. In the context of Amazonian communities, subtle neurological dysfunctions were observed in adults

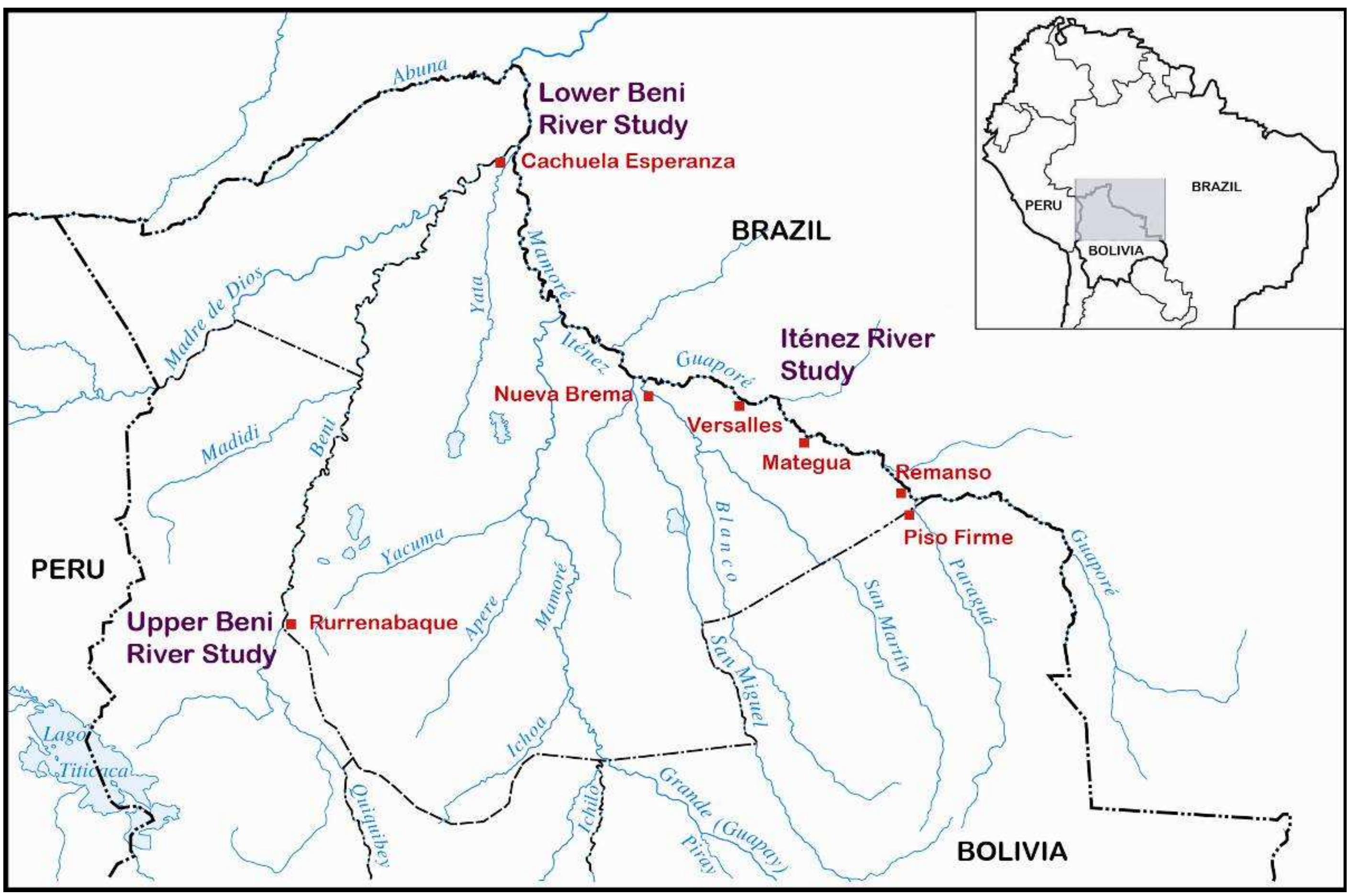

Figure 1. Bolivian Amazonian basin and location of the studies

and children. Studies also found evidence of immunotoxicity and citotoxicity, as well as cardiovascular effects.

The BMDL (Benchmark Dose Limit) determined for total mercury in maternal hair based on the neurological development of the child is 10 µg/g, which corresponds to 58 µg/g of total mercury in umbilical cord blood. The current Reference Dose (RfD) recommended by the EPA is 0.1 µg/kg/day, which corresponds to 1 µg/g of total hair mercury. Even though this RfD is simply a Public Health precaution policy, it shows the current tendency to handle lower acceptable values. Considering this preventive attitude, several Amazonian populations seem to be exposed to unsafe mercury levels. Indeed, hair mercury concentrations in Brazilian Amazonian riverside communities range from 10 to above 20 µg/g in the Tapajós River and around 14 µg/g in the Madeira River.

Considering the public health implications of this situation, it should be a priority to document mercury exposure levels all around the Amazonian regions, in order to identify the communities at risk. This is essential to elaborate adequate public health policies according to the characteristics and the needs of each population.

MULTIDISCIPLINARY STUDIES IN BOLIVIA

An assessment of mercury contamination being developed in Bolivia since 2005, has focused on the Amazonian environments and potentially exposed populations. These studies have been conducted together with the IRD (French Institute of Research for Development), the UMSA (Major University of San Andrés, La Paz, Bolivia) and the UMSS (Major University of San Simón), using a multidisciplinary approach and including the areas of ecology, geography, geochemistry, health and biochemistry, amongst others.

The studies have been carried out in three distinctive areas: the upper Beni River, the lower Beni River and the Iténez River basin. These three studies had distinct objectives; we will focus here on the exposure evaluation results. As in the majority of Amazonian studies, total hair mercury concentration was used to characterize mercury exposure. In most fish eating populations, methylmercury corresponds to more than 95% of total mercury concentrations in human hair, and it is considered a very valuable biomarker for exposure assessment.

Figure 2. Alluvial gold mining in Cachuela Esperanza, lower Beni River

Figure 3. Children fishing in Rurrenabaque, upper Beni River

The objective of the upper Beni study (Monrroy et al. 2008) was to document mercury exposure of riverside populations and to examine risk factors associated to their lifestyle. The survey involved 556 subjects (163 women; 393 children) from 15 communities of the Beni River at the piedmont of the Andes. Lifestyle was analyzed considering community accessibility, subsistence activity, fish consumption and ethnicity. The mean of hair mercury was 3.70 µg/g, ranging from 0.08 to 34.10 µg/g. Approximately 14% of the subjects had values higher than the BMDL of 10 µg/g. No significant difference in hair mercury concentration was observed between women and children. Subjects belonging to the *Ese Ejja* ethnic group (traditional nomadic fisherman) had higher hair mercury levels than subjects from the *Tacanas* ethnic group (farmers). Communities accessible only by river were more frequently contaminated than those accessible by road. Subjects who ate at least one serving of fish per day had higher mercury levels, and families who maintained substantial fishing activity were also more exposed.

The lower Beni River study (Barbieri et al. *In Press*) involved 150 riverside inhabitants of Cachuela Esperanza, a rather large village where there are intense gold mining activities and high fish consumption. We used simple random sampling from the whole population in order to obtain a representative evaluation of the contamination. Then, we performed a survey by interview and we took hair samples to measure total mercury concentrations. We focused our attention on fish consumption and occupational activities of the participants to identify contamination associated factors. The hair mercury geometric mean in the general population was 3.02 µg/g (CI: 2.69-3.37; range: 0.42-15.65). Age and gender were not directly associated with mercury levels and neither were socio-economic indicators. Fish consumption and small-scale gold mining participation was found to be associated with higher levels of contamination. Hair mercury concentrations in Cachuela Esperanza were below health impact levels, but three times higher than the current EPA recommendation.

The Iténez River study aimed to assess mercury exposure in a different Bolivian river basin, where mercury contamination is suspected to be intensified by gold exploitation in the San Simón Mount. We surveyed 302 subjects from five communities; three from the Iténez River shore, one from the Paraguá

Figure 4. Hair sampling in Cachuela Esperanza, lower Beni River

Figure 5. Informed consents and questionnaires in Mategua, Iténez River

River shore and one from the Blanco River shore, both Iténez tributaries and distant from San Simón. We also performed a questionnaire regarding habits, occupation and fish consumption. The hair mercury geometric mean in the general population was 2.94 µg/g (CI: 2.78-3.11), ranging from 0.25 to 13.29 µg/g. Only 0.6% of the population had mercury levels higher than 10 µg/g. The hair mercury levels in the three populations from the Iténez River were significantly higher than the other two communities. We found a strong positive relation between fish consumption and hair mercury, regardless of the river basin. As also seen on the Beni River, even the most exposed populations from the Iténez River had relatively low hair mercury levels.

These three studies from Bolivian Amazonian regions show a quite homogeneous situation with levels far below those observed in Brazil. Although these regions have ecological resemblance with Madeira or Tapajos regions, mercury exposure appear lower than one third. In fact, all the results from these Bolivian studies remain well below the "accepted" limit value of 10 µg/g.

The relations between environmental mercury contamination, fish consumption and human exposure were evidenced and properly backed up by the other components, such as geochemistry, limnology, etc. For example, the mercury concentrations in fish tissue were significantly higher in species from the Iténez River than the ones from its less polluted tributaries, and the same difference was observed in hair mercury concentrations on that river basin.

Besides the environmental characteristics, habits and lifestyle play an essential role as determinants of mercury exposure. In fact, the most affected groups were those which preserved a traditional way of life and were the most economically and socially disadvantaged. For these riverside communities, fish consumption is the main and almost unique source of protein, and the sanitary impact of this situation has not been sufficiently documented. As a consequence, the scientific community does not reach a consensus on the attitude towards the public health policies.

MEDICAL GEOLOGY IN IRAN

S. H. M. Meyguni, Director of International affairs, Geological Survey of Iran (GSI)
International@gsi.ir

The Geological Survey of Iran (GSI) medical geology management has created an active relation with IMGA, with a formal structure. In Iran there are geographical belts of diseases, such as esophageal cancer, goiter, anemia, thalassemia major, etc., and national research in medical geology is necessary. Considering the importance of medical geology, the Geological Survey of Iran has established an Executive Unit of Medical Geology Research and also an active chapter of IMGA in Iran.

THE DIRECTORS OF THE IRANIAN CHAPTER ARE:

Mr. Mohammad Taghi Korehie, Director of the Geological Survey of Iran.
Mrs. Farah Rahmany, Executive Manager of Medical Geology Management, Geological Survey of Iran.
Miss. Parisa Piroozfar, Executive Assistant
Mr. Abdolmajid Yaghubpur, Councillor, Professor of Economic Geology, Tarbiat Moalem University, 49 Mofateh Av. Tehran 15614, Iran.
Vahid Otarod, Councillor, Epidemiologist, Iran Veterinary Organization.

THE MAIN GOALS ARE:

- Medical geochemical studies of soils and sediments (thematic, local, and regional) for determining qualitative and quantitative roles of different elements on human health.
- Sampling, field work, processing laboratory data and determining areas of geogenic and anthropogenic origin.
- Compilation of the latest standards for human health, from the effects of sediments and soils with different usage, considering the geological situation of the study areas.
- Preparation of medical geology maps, and determining desirable limits of elements. Using GIS for analysis, display and data compilation.
- Determining geological processes that affect the distribution of toxic elements and their role on human health.
- Hydrological and hydrogeochemical studies on surface water and groundwater used for drinking and in agriculture. Qualitative and quantitative studies on elements and pollutants. Preparation of hydrogeochemical maps and quantitative measurement of pollutants.
- Mapping of different materials (water, soil, sediment, plant, organisms and minerals) for determining the radiological impact. Quantitative and qualitative measurement of radioactive elements in biologic materials.
- Radioactive uptake by people, radiological research and studies on the effects of radioactivity on human health. Environmental models.
- Compilation of regional standards for natural radioactive elements compared to international standards.
- Studies on plant diversity in different areas including determination of species and sub- species, abundant and rare species, preparation of distribution maps.
- Herbal sociological study, determination of indicators and determination of abundant and rare species.
- Studies on plants with resistance to pollutants such as elements (e.g., heavy metals). Determining element concentration in plants, determination of reservoir organs and usage of plants.
- Effects of environmental factors on plant morphology.
- Study of acute and chronic diseases.
- Study of different factors which cause diseases using available data (water, soil, natural radioactive elements and plants).
- Presentation of statistical reports to international research centers.
- Veterinary studies considering medical geology.
- Gathering reports about local diseases in different areas, archiving them and determination of priorities.

INTERNATIONAL ACTIVITIES:

1. Medical geology studies in the Central Asian Esophageal Cancer Belt within the context of the

United Nations International Year of Planet Earth, UNESCO, and the medical geology management of Iran. This will provide a multidisciplinary platform for interaction between geological and environmental scientists with special emphasis on the relationship between natural geological factors and health problems. In this project, the north provinces of Iran and a number of countries in the Central Asia region which that have high incidence rate of this cancer will be studied as a part of the Cancer Belt. As this cancer belt coincides with a loess deposit belt, it is believed that an undiscovered geological risk factor (such as selenium deficiency, zinc deficiency, silica fibers, …) may exist. This study includes hydrogeochemistry, geochemistry, geobotany, and natural radionuclides.

2. Agreement between the Geological Survey of Iran and the Institute of Geological Sciences of Armenia for medical geology research.
3. Agreement between the Geological Survey of Iran and ECO members.
4. Agreement between the Geological Survey of Iran and Sudan for medical geology research.

Recent national studies and activities:

- Natural radionuclides in Yazd, Ramsar, and western Azerbayjan province.
- Breast cancer in Langrud city (the region of highest breast cancer incidence in Iran).
- Children's blood cancer in Tehran.
- Incidence of cancer in the central desert of Iran.
- Fluorosis in Boushehr (south of Iran).
- Malnutrition and iron and zinc deficiency in southern Iran.
- Completion of Medical geology studies on Tehran.
- Preparing a medical geology atlas of Tehran according to the distribution of geogenic pollutants, natural radioactive elements in soil and water samples, and their effects on local diseases.
- Preparation of the first medical geology atlas of Iran (cancers, acute and chronic diseases).
- Preparation of first geo-veterinary atlas of Iran.
- Preparation of first geobotany atlas of Iran.
- Distribution of ophiolites and incidence of respiratory cancer, skin cancer, cardiovascular disorders, kidney cancer silicosis and asbestosis (the results of study will be published as an atlas).
- Cu-province effects on endemic diseases.
- Relation between soil geochemistry and carbon in animals (the results of the study will be published as an atlas).

Present activities:

HYDROGEOCHEMISTRY AND POLLUTION OF GROUNDWATER IN TEHRAN (WELLS & RESERVOIRS). 1:50000 Sheet (focussed on Medical Geology). Executive Division of Geomedical Research (Geology and Mineral Exploitation Organization)

Different natural factors cause limitations, to the excessive use to drinking water. One of these is anthropogenic and geologic pollution of water resources, which that has a direct relation to the general health of society. Tehran's industrial and urban development has been rapid within the last two decades, and this has resulted in several dangers, one of them being groundwater pollution.

Natural pollution is due to soil and bedrock and the existence of ore mineral veins. In places located in volcanic rocks, the amount of some elements, nitrate, and nitrite may be high in the groundwater.

Pollution by human sources: industrial and agricultural developments, are other water contaminating agents. Toxic elements and heavy metals in residues of industries, fertilizers, and pesticides may cause pollution in groundwater. Results show the existence of nitrate in Tehran water wells, which can cause respiratory diseases especially in children under one year as well as digestive diseases in adults. Furthermore, some maps show high concentrations of sodium, magnesium, manganese, iron, zinc, cobalt, chrome, ammonia, sulphate, sodium and chloride in South and Southeast of Tehran. Total water hardness also needs more consideration, with regard to kidney diseases and urine ducts. A significant part of water pollution comes from detergents, nitrates, and nitrites. The nitrate concentration is more than 45 mg/L (standard limit) in most samples, due to urban sewage. Heavy metals such as mercury, and arsenic are also observed as a result of textile, leather, detergent, and welding industries. It is necessary to study our water resources more.

NATURAL RADIONUCLIDES IN WATER AND SEDIMENTS OF TEHRAN 1:100000 geologic map (Tehran, Karaj, and Shahryar 1:50000 sheets)

It is very important to study and understand radionuclide resources. The surveyed region includes the Tehran, Karaj, Shahryar 1:50000 sheets. Regarding the relation between water and sediment geochemistry and their direct effect on human health, water and sediments have been studied simultaneously. Samples have been analyzed for natural radionuclides ^{40}K, ^{226}Ra, ^{232}Th and the artificial radionuclides ^{137}Cs and ^{226}Ra, ^{137}Cs, ^{222}Rn, and total U in water samples. The results indicate that ^{232}Th in sediment samples of Karaj and Shahryar is normal in comparision to UNSCEAR standard but the average amounts of ^{40}K and ^{226}Ra are greater than the standard. ^{137}Cs in sediments is from anthropogenic resources (nuclear activities). The average amount of radionuclides is very close to the background in ground and surface waters. Accessing more meticulous data and finding geogenic relation between radionuclides and geological units require complementary studies in smaller scales.

GEOCHEMISTRY AND POLLUTION OF SOIL AND SEDIMENT IN TEHRAN 1:100000 Sheet (focussed on Medical Geology)

The abundance of natural elements in soil and their availability for plants and animals is important to the relationship between geology, medical, and environmental health. The significance of studying natural elements in sediments and urban soils is shown by the geomedical research division which has investigated sediments in Karaj, Shahryar, Tajrish, and soils of Tehran (industrial areas in western Tehran and Taleghani, Azadegan, and Moshirieh parks). The results have been evaluated using soil and sediment standards from Canada and Australia. Anomalies are present for arsenic, cadmium, lead, and zinc, in sediments of northeast and northwest, and for arsenic, beryllium, cadmium, zinc, copper, lead and nickel, in Tehran soils. In order to evaluate health effects it is necessary to have detailed studies. In our research on the concentration of elements in farms in the south of Tehran that are irrigated with surficial urban water, we have shown increased contents in some vegetables that affect human health.

HYDROGEOCHEMISTRY AND POLLUTION OF SURFACE WATER IN TEHRAN 1:100000 Sheet (focussed on Medical Geology)

Understanding geochemical processes and geogenic contaminants in water is necessary to delineating health effects in humans and animals. The research division of GSI and Tehran water and sewer organisation has sampled surface waters in Kalaj, Shahryar, Tajrish. 157 samples of surface water (river, drainages, springs) were taken and were analysed for 28 elements. The surface waters are exposed to significant pollution. It is also recommended to have detailed studies for recognizing critical points regarding the irrigation of south agricultural farms in Tehran by surface waters and the concentration of these elements in different plants parts and their effect on humans health.

We have requests for the medical geology community:

- We would like to have international experts in environmental geochemistry, hydrogeochemistry, natural radionuclides, geobotany to educate Iranian experts.
- We would like to design short courses on medical geology in Iran in cooperation with IMGA.
- We would like to write reference books, magazines and articles in collaboration with international colleagues.

CONDITIONS OF THE NATURAL ENVIRONMENT COMPONENTS ACCORDING TO ECOLOGICAL-GEOCHEMICAL MONITORING AND POPULATION HEALTH DATA (TOMSK REGION)

L. P. Rikhvanov, E. G. Yazikov, N.V. Baranovskaya, A.M Belyaeva,
L.V.Zhornyak, A.V. Talovskaya, *Tomsk Polytechnic University*
O.A. Denisova, *Siberian State Medical University*
Yu.I. Sukhikh, *Tomsk Central District Hospital*
E-mail: *rikhvanov@tpu.ru*

Many factors are known to determine mankind's state of health: life-style (51%), heredity (21%), public health service (8%) and habitat quality (ecological factor), the latter amounting to approximately 20% according to World Health Organization (WHO) statistics.

Gichev (2002), Revich (2004) et al., identified an entire group now termed ecological condition diseases. Depending on the environmental factors, the most significant of the diseases resulting from ecological conditions are the natural chemical factors; the organic and inorganic compounds in major natural environments interacting with man. For example, 7-10% of childhood respiratory disease is the result of air pollution, 3-15% bronchial asthma (according to WHO). Approximately 40 thousand deaths are due to air pollution in different cities of Russia (Revich, 2001).

At present, to determine the significance of natural environmental factors in the development of abnormal health impairments (disorders), risk evaluation methodology is widely applied. This is the most effective toolbox to determine the main disease causes and to provide management solutions (Onischenko, et al, 2002). They include the content of different chemical ingredients in the components of the major natural environment, the form in the different locations, dynamic changes of these factors, etc. It is necessary to conduct ecological-geochemical monitoring and evaluation of the state of population health.

Scientific research in this area has been conducted by the staff of the Geoecology and Geochemistry Department, Tomsk Polytechnic University in the Tomsk region [Adam et al (1993), Rikhvanov et al (1994), Sarnaev et al (1995), Rikhvanov et al (2006), Sukhikh (2001), Yazikov et al (2006)] and adjacent territories in the Ob basin [Shatilov et al (2001)].

The Tomsk region, especially in the densely populated southern part, is characterised by the high- technogenic impact of different enterprises [Adam et al (2000), Adam et al (2001), Adam et al (2003], including existing oil and gas producing enterprises (predominantly in the northern regions), oil refining (Tomsk Petroleum-Chemical Plant), a nuclear-fuel plant (Siberian Chemical Plant), energy plants (numerous Heat-Energy Centers and City Electricity Stations operating on coal), agro-industrial complexes, and others.

Besides the above-mentioned problems, the following should also be included: detached missile parts falling on this territory (total area of about 2.14 mil. hectare) with fuel component dispersion, existing transboundary aerosol and water pollution fluxes on the Tom River from industrial plants of Kemerov region [Rikhvanov et al (2006)].

Not only an integrated approach but also different specialists are required to investigate the natural environmental conditions and to establish those factors that influence the population health. The research methodology is based on the theoretical concepts of such Tomsk scientists as B.G. Ioganzen, I.P. Laptev and N.V. Vasilev, who are considered to be the founders of the ecological approaches in the natural environment quality and man's health state evaluation.

This monitoring includes the following principles:
1. Research is integrated and based on geochemical and geophysical methods;
2. The evaluation of the accumulated chemical component levels in different parts of the territory are conducted simultaneously (close in time), and the natural environmental samples (snow, soil, biota and

other components) are selected from areas close to these conditions;
3. Research includes a maximum number of the deposited components of the natural environment capable of preserving contaminants for a long period of time, in which temporary accumulation intervals can be determined in these components (snow, soil, peat, hair according to growth length, etc.);
4. Sampling, sample selection, and element analysis, are conducted in accordance to a standard uniform method separately for each environment type, including comparison samples in laboratories. The maximum possible chemical element components in micro-biological water composition (heavy metals, radioactive and rare-earth elements, technogenic radionuclides and major aromatic hydrocarbons and others) are determined;
5. Solid mineral formations in natural environmental components are studied by applying contemporary research methods in ecological mineralogy (electron microscope, micro-sonde, laser micro-analysis, X-ray phase analysis and others).
6. Geochemical (Th/U, La/Yb, La/Ce, La+Ce/ Yb+Lu, and others) and bio-indicator factors (chromosome aberration, micro-nuclear testing and others) are applied in evaluating the environmental conditions in those regions where radioactivity and other factor impact exists;
7. Computerized mathematical processing of geochemical analysis information is applied, highlighting the reliability of obtained data, which, in its turn is based on the irregular sampling system and small sampling selection volume;
8. Application of geoinformation system (GIS) technology in mapping a single coordinate system and further maps [Adam et al (1993), Rikhvanov et al (1994), Yazikov et al (2006)].

The objects of research in the ecological geochemical zoning of Tomsk region are soil, solid precipitate of snow samples (dust-aerosol formations of snow surfaces), salt formations from crockery; (scale), as well as children's hair and human thyroid gland. In addition, there is sufficient information on such natural environment sources as peat (A. M. Beljaeva et al.), lake bottom sediments (A. U. Ivanov et al.), tree age-rings (T. A. Arkhangelskaya et al.) which are referred to as stratified (sequence) formations indicating the chemical component intake dynamics and further retrospective evaluation of natural environment transformations in time [Rikhvanov et al (2006)].

Retrospective analysis of the technogenic component intake in the natural environment of Tomsk region (especially its southern part) indicates a significant dust-aerosol development during the 20th century (Fig. 1), and correspondingly, a significant amount of contaminants. This is based on the research results of peat in southern Tomsk region [Rikhvanov et al (2006)].

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Figure 1. Cumulative curve showing peat contamination with heavy metals in Tomsk surroundings ((«Aerosol…» 1993)

The following graphics (Fig. 2) show an intensive flux of specific radionuclides and other elements in the natural environment of the southern Tomsk region during the second half of the 20th century.

The results correspond to previous research data which was based on Kirsanovsk swamp peats in the southern Tomsk region [V. M. Gavshina et al (2003)].

Soil is a continuuously depositing environment. Many natural and anthropogenic characteristic factors influence micro-element accumulation level in the soil, such as soil-forming substratum composition,

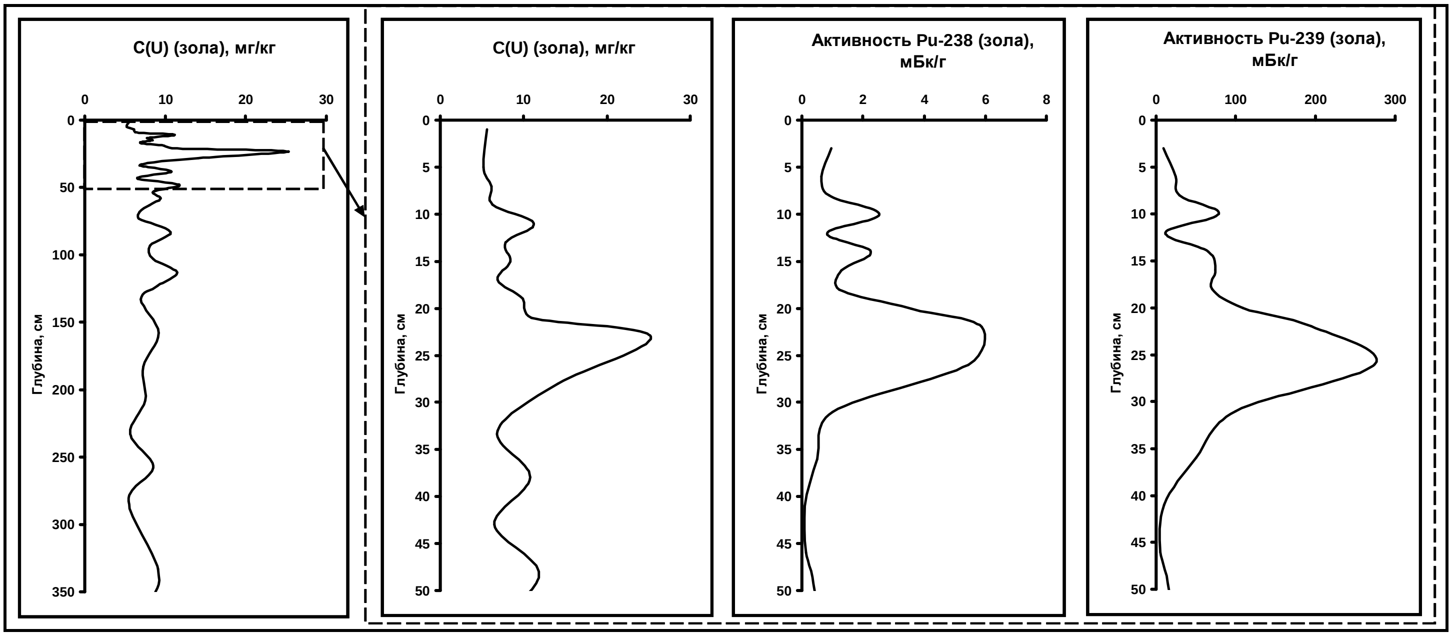

Figure 2. Distribution of uranium and plutonium isotopes in upper peat region, Tomsk.
Мг/кг – mg\kg, Г- gram, g, мБк/г – milliBq/g, Активность - activity, Зола - ash

geochemical landscape and soil types, technogenic flows and so on. However, the soils investigated in the Tomsk region indicated their technogenic transformation [Rikhvanov et al (1994)]. Ranking of the regions according to the accumulation level of several micro-elements (23 of 50 studied) is depicted in Fig. 3.

It should be noted that in those zones where nuclear-energy enterprises are located, the soil in the Tomsk region shows a distinct increase in the regional background of dense technogenic radionuclide fall-out, for example, ^{137}Cs (Fig. 4).

Solid snow precipitates are winter- only environment, and indicates a distinct technogenic composition. Data analysis (Fig. 5 and 6) shows a specific technogenic impact in oil and gas recovery regions (Sb, Br), and coal and nuclear energy enterprises (La, U, Th). According to the micro-element content in solid snow precipitates it is possible to map the technogenic transformation zones [Shatilov, (2001)].

Salt accumulations in crockery (scale) indicate not only the natural quality of drinking water (Fig. 7), but also, in some cases when using perched groundwater, the technogenic component existence [Yazikov et al (2004)].

The composition of animal and human bio-substance, organs and tissues depends on many factors, including the fact that their geochemical characteristics reflect specific natural and technogenic impact [Baranovskaya (2003), Baranovskaya et al (2006)].

Thus, special attention was paid to the following fact, significant U and La accumulation level in children's hair (children from Seversk-a town located within the closed zone of Siberian Chemical Plant – Fig. 8). The spatial dating of specific element anomalies and their ratio can be seen on the maps in Fig 9.

Research into the micro-element substances in thyroid glands of the Tomsk region population [Baranovskaya et al (2006)] indicated that each administrative district has its specific geochemical characteristics according to the concentration coefficient of studied micro-elements (Table 1).

However, each district has its distinct geochemical

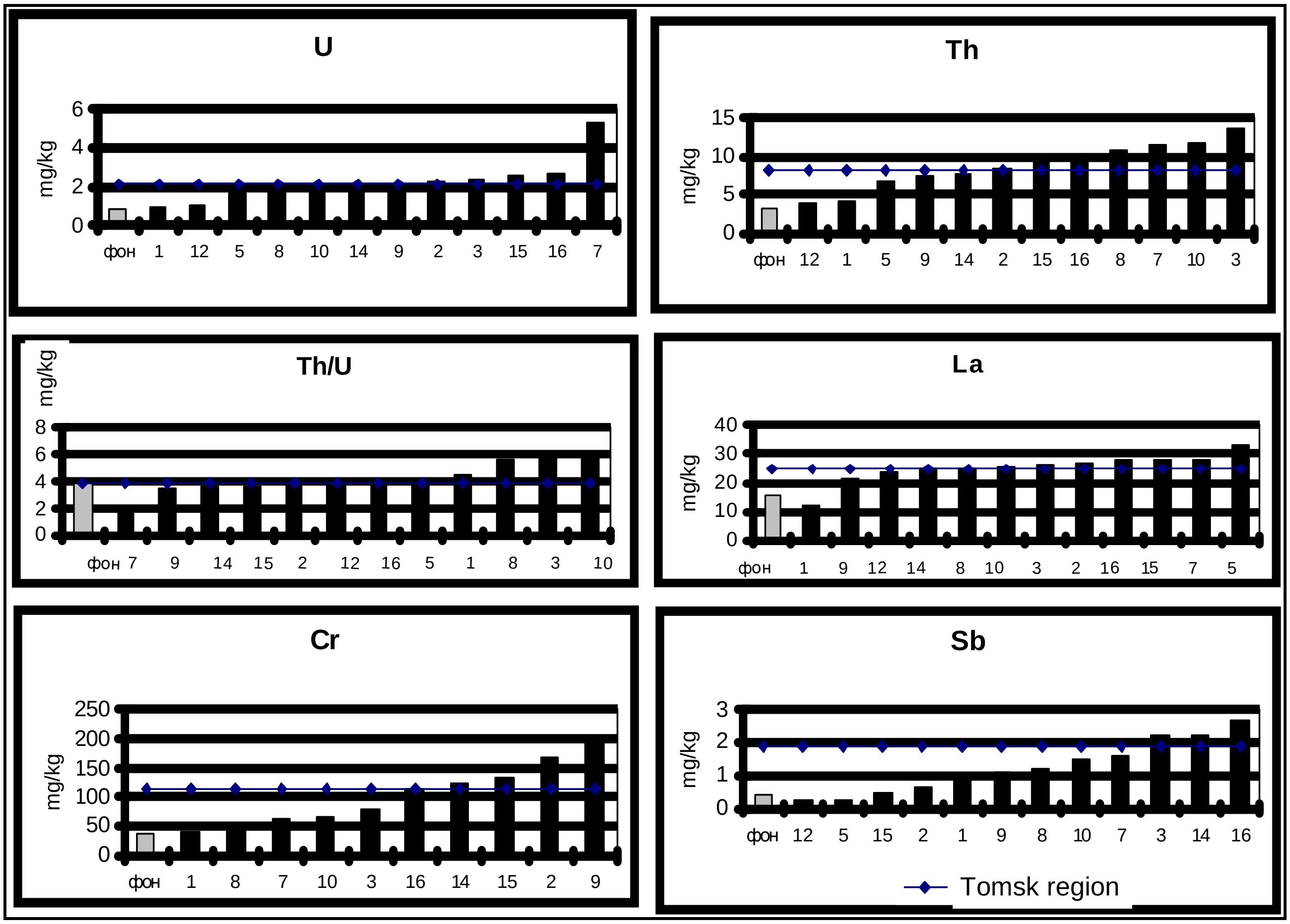

Figure 3. Ranking districts in Tomsk region according to content of several micro-elements and Th/U ratio in soil
Фон- check sample

The following are also included in all further figures: 1 –Aleksandrovsk; 2 – Asinovsk; 3 – Bakcharsk; 4 – Verneketsk; 5 –Zirjansk; 6 – Kargasoksk; 7 –Kozhevnikovsk; 8 – Kolpashevsk; 9 –Krivosheinsk; 10 –Molchanovsk; 11 –Parabelsk; 12 – Pervomaisk;13 – Teguldetsk; 14 – Tomsk; 15 – Chainsk; 16 –Shegarsk; 17 – Seversk (town).

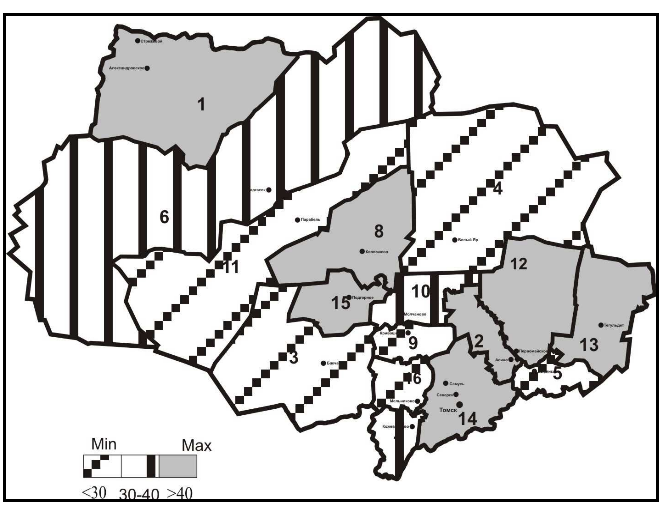

Figure 4. ^{137}Cs content in soil (mCi/km^2) of Tomsk region (according to the data from Regional Government Department «Oblkompriiroda»)

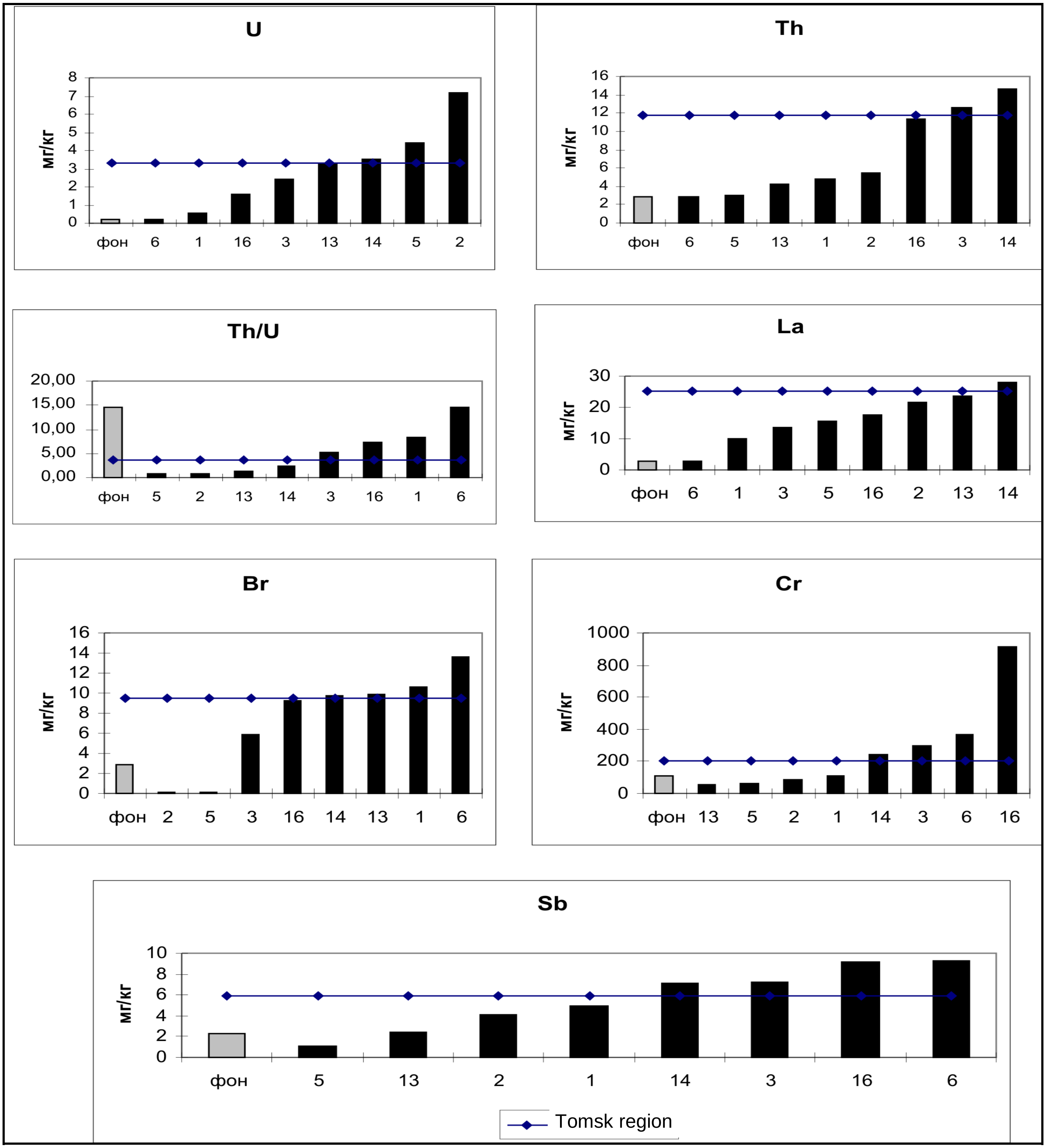

Figure 5. Ranking districts in Tomsk region according to content of several micro-elements and Th/U ratio in dust-aerosol snow surfaces
Мг/кг – mg\kg, Фон- check sample,

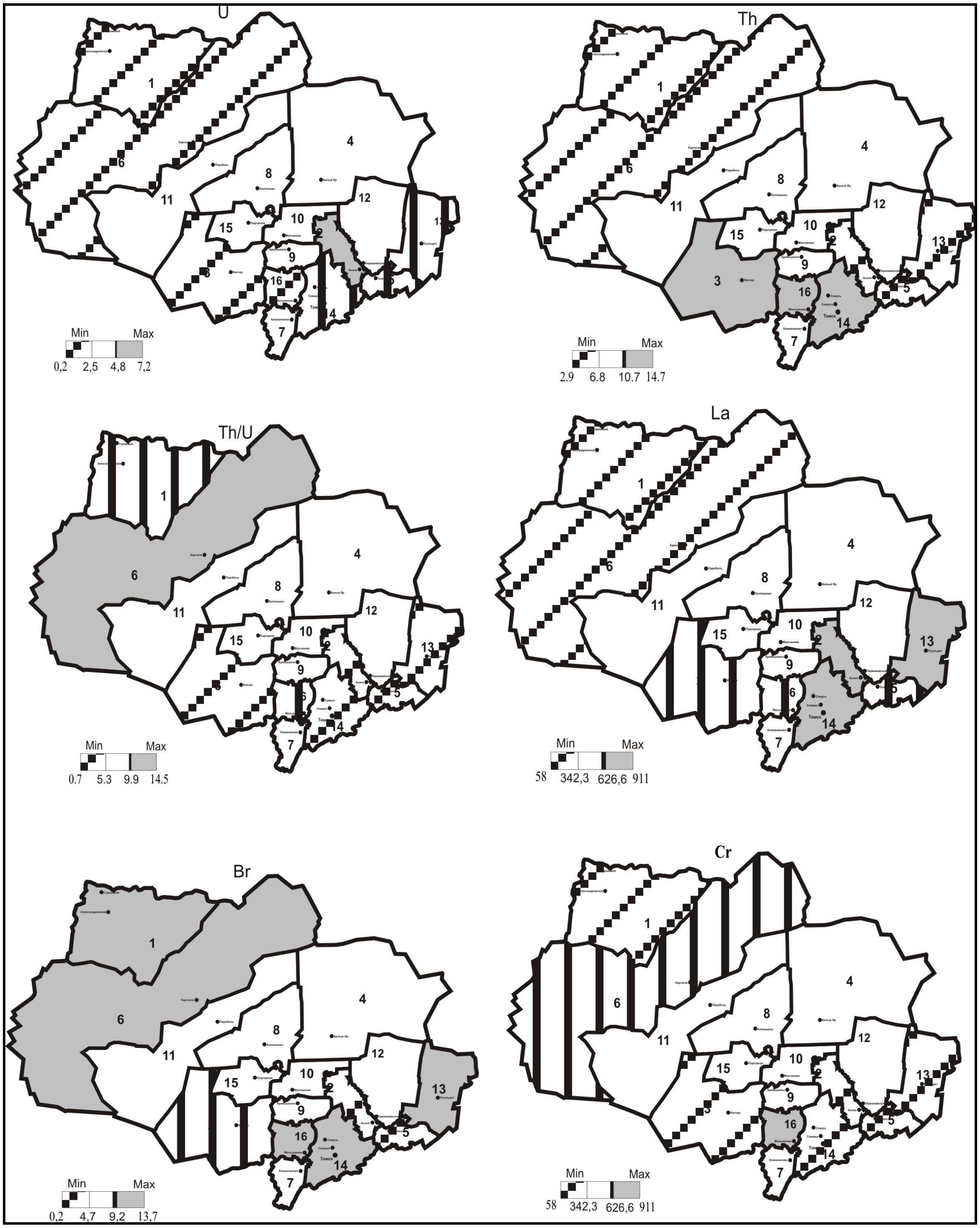

Figure 6. Spatial distribution of several micro-element contents (mg/kg) in dust- aerosol districts in Tomsk region

The following are included in all further figures: 1 –Aleksandrovsk; 2 – Asinovsk; 3 – Bakcharsk; 4 – Verneketsk; 5 –Zirjansk; 6 – Kargasoksk; 7 –Kozhevnikovsk; 8 – Kolpashevsk; 9 –Krivosheinsk; 10 –Molchanovsk; 11 –Parabelsk; 12 – Pervomaisk;13 – Teguldetsk; 14 – Tomsk; 15 – Chainsk; 16 –Shegarsk;17 – Seversk (town); white spots- no data.

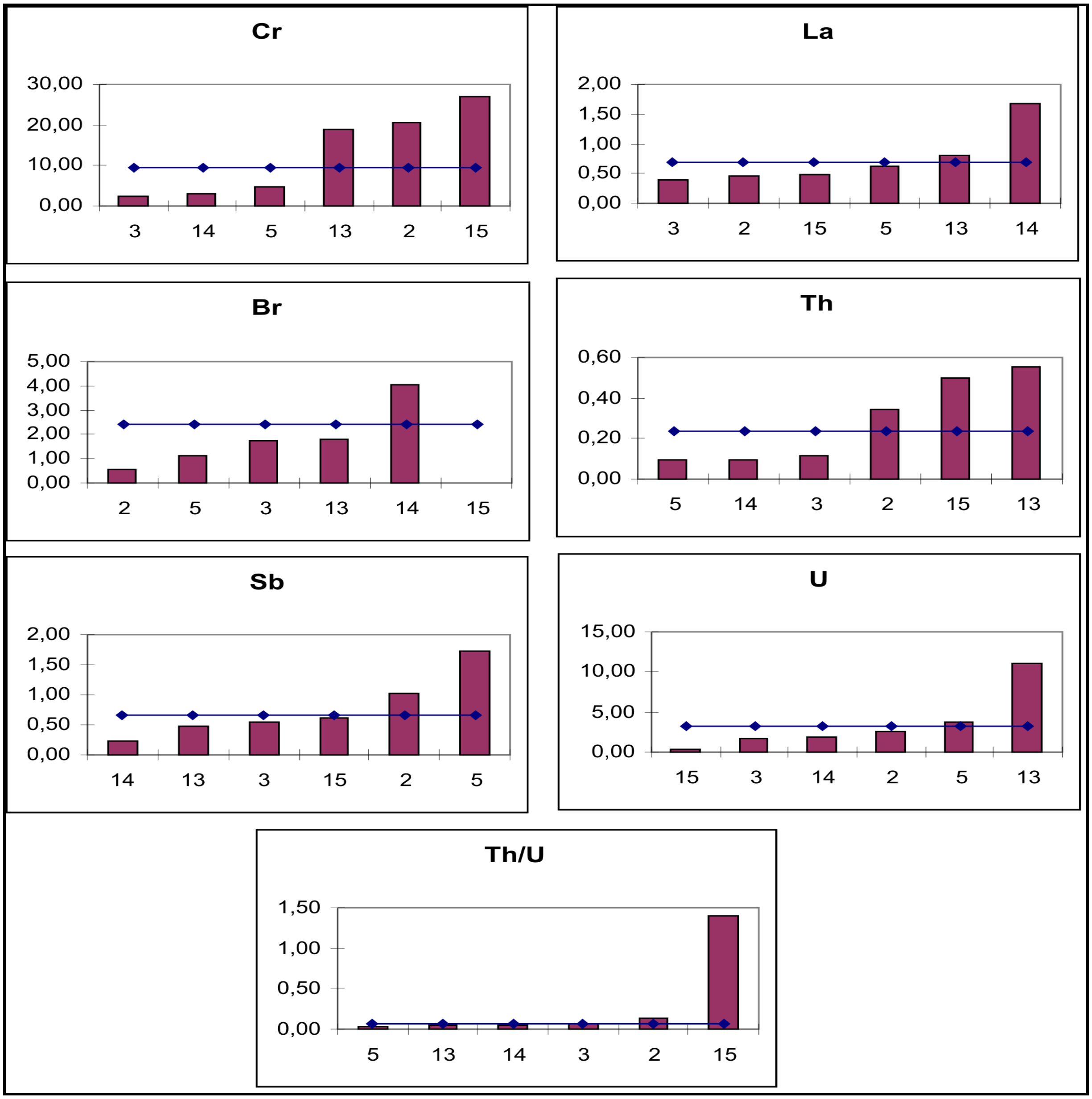

Figure 7. Ranking districts in Tomsk region according to content of several micro-elements (mg/kg) and Th/U ratio in salt accumulations in crockery (scale)

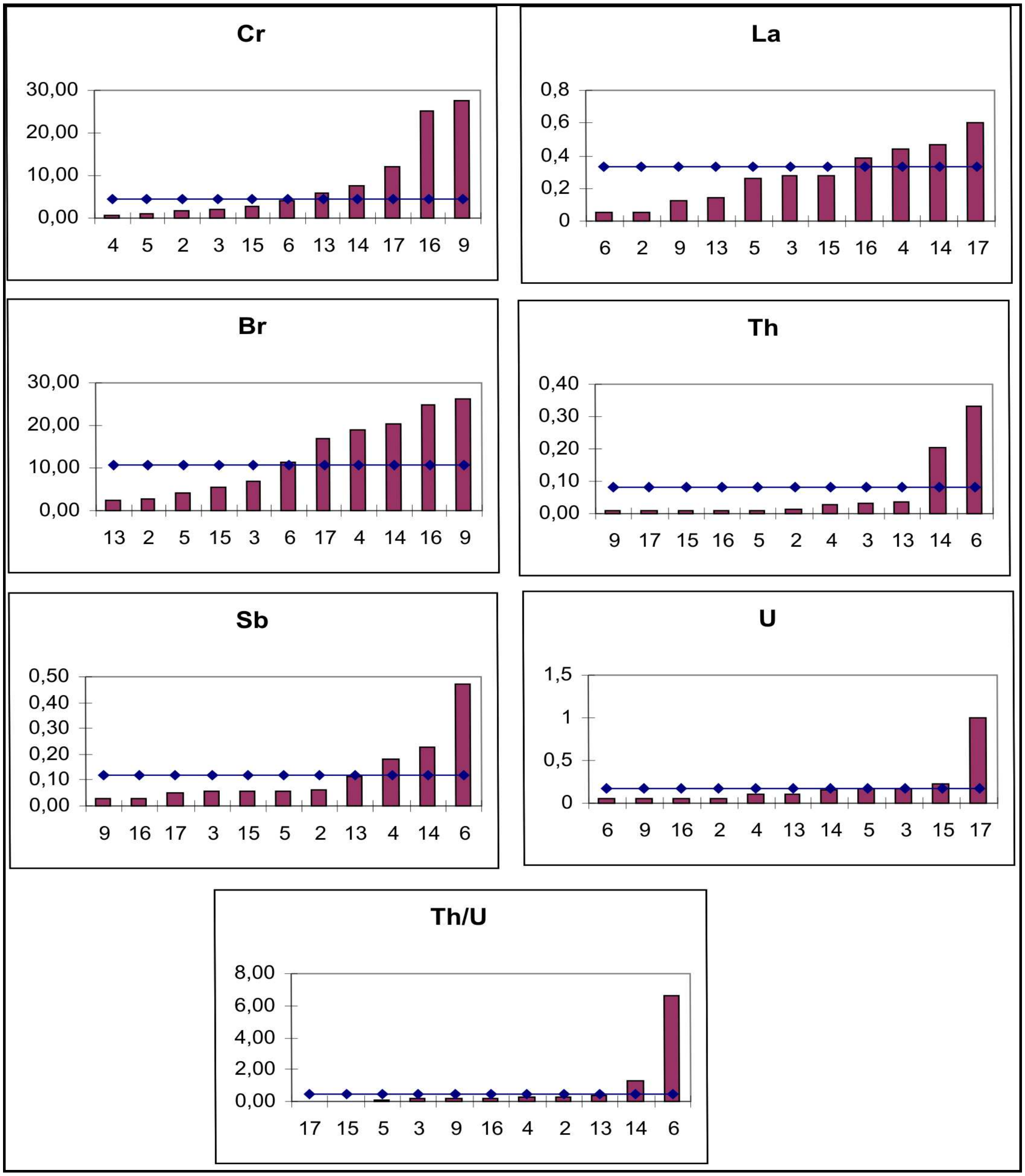

Figure 8. Ranking districts in Tomsk region according to content of several micro-elements (mg/kg) and Th/U ratio in children's hair

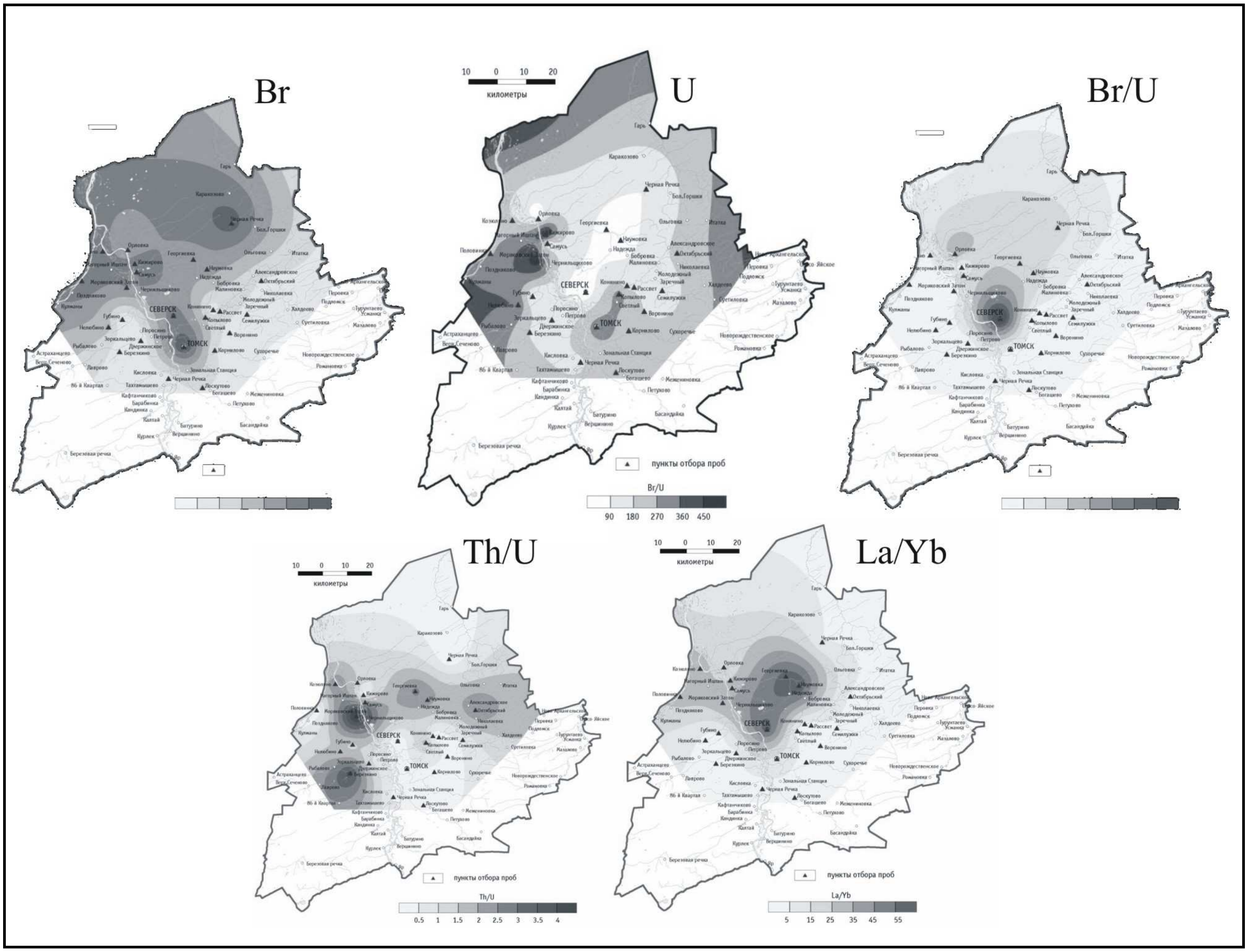

Figure 9. Specific element distribution (mg/kg) and their ratio in Tomsk region territories according to micro-element children hair composition data

characteristics (Fig. 10 and 11). Thus, Tomsk district has significant uranium accumulations; Asinovsk, Kargasoksk and Kozhevnikovsk districts, stibnium (antimony); Bakcharsk and Verneketsk, chromium, Krivosheinsk, thorium, etc. Thus, the location of habitation definitely influences the specific characteristics of thyroid gland diseases. Therefore, collected data makes it possible to forecast the thyroid gland pathology of the population and plan preventive health activities.

It should be noted that significant anomalous bromine concentration coefficients in Aleksandrovsk and Shegarsk districts are due to single anomaly sample occurrences. Such significant accumulations under specific pathology conditions and in definite population locations require additional study and investigation.

Collected research material in the ecologic-geochemical district zoning of the Tomsk region based on the study of different natural environments, which in its turn, included a wide range of micro-elements, determined by quantity neutron-activation analysis, is considered to be satisfactory in accordance with administrative district ranking (Fig. 12). The latter is a factor of total environment contamination determined by the Federal Department in the

District	Geochemical specific characteristics
Tomsk	Br_{74}-$Fe_{4,5}$-$U_{3,5}$-$Hf_{2,8}$-$Cr_{1,9}$-$Rb_{1,9}$-$Na_{1,8}$-$Hg_{1,3}$-$Sb_{1,3}$
Asinovsk	Sb_{20}- $Fe_{3,4}$- $Na_{2,7}$- $Br_{1,9}$- $Rb_{1,7}$- $Hf_{1,7}$- $Hg_{1,5}$- $Cr_{1,3}$-$Co_{1,2}$
Pervomaisk	$Fe_{2,4}$-$Hf_{1,7}$- $Rb_{1,5}$- $Sb_{1,5}$- $Hg_{1,4}$- $Br_{1,3}$ - $Cr_{1,3}$- $Na_{1,2}$-$Zn_{1,1}$
Zirjansk	Br_{10}- Fe_{8}- Hg_{3}- $Zn_{1,6}$- $Sb_{1,3}$- $Co_{1,1}$-$La_{1,1}$
Bakcharsk	$Cr_{4,8}$- $Fe_{3,8}$- $Na_{2,4}$- $Rb_{1,4}$-$Sc_{1,3}$-$Sb_{1,3}$- $Br_{1,3}$-
Parabelsk	$Na_{2,9}$- $Rb_{1,8}$-$Au_{1,7}$- $Br_{1,5}$- $Hg_{1,5}$- $Fe_{1,2}$
Kozhevnikovsk	Sb_{24}- $Fe_{3,3}$-$Hf_{2,2}$-$Na_{1,8}$- $Hg_{1,8}$-$Rb_{1,8}$- $Br_{1,7}$-$Au_{1,4}$
Chainsk	Br_{33}- Na_{3}- $Fe_{1,8}$- $Cr_{1,6}$- $Hf_{1,5}$- $Rb_{1,5}$- $Co_{1,1}$
Molchanovsk	Fe_{5}- Hg_{3}- $Sb_{2,2}$- $Na_{1,9}$- $Cr_{1,9}$- $Br_{1,7}$- $Rb_{1,5}$- $Co_{1,2}$- $Au_{1,1}$
Kolpashevsk	Br_{28}- $Fe_{6,2}$- Na_{6}- $Rb_{3,3}$- $Sb_{2,1}$- $Hf_{1,8}$- $Hg_{1,7}$- $Co_{1,2}$- $Zn_{1,1}$
Aleksandrovsk	Br_{116}-$Cr_{4,1}$-Na_{4}-Rb_{4}-$Sb_{3,7}$-$Fe_{3,6}$-Ce_{2}-$Hf_{1,6}$-$Hg_{1,4}$-$Co_{1,3}$-$Zn_{1,1}$
Shegarsk	Br_{269}-Sb_{9}- Fe_{5}- Hg_{4}- $Na_{3,4}$- $Cr_{3,4}$- Th_{3}- $Rb_{2,4}$- Hf_{2}- $Zn_{1,4}$
Kargasoksk	Sb_{85}- Fe_{5}- $Cr_{4,2}$-$Rb_{1,8}$- $Au_{1,7}$- $Hf_{1,7}$- $Br_{1,5}$- $Sc_{1,3}$- $Hg_{1,3}$
Krivosheinsk	$Th_{5,5}$-Na_{5}-$Rb_{4,7}$-$Br_{2,7}$-$Sb_{2,3}$-$Fe_{2,1}$-Co_{2}-Hg_{2}-$Au_{1,7}$-$La_{1,3}$-$Zn_{1,3}$
Verneketsk	Cr_{6}-Hg_{5}-$Fe_{4,7}$-$Th_{3,2}$-$Sb_{2,7}$-$Br_{2,6}$-$Na_{2,3}$-$Rb_{1,4}$-$La_{1,4}$-$Zn_{1,3}$-$Au_{1,2}Co_{1,1}$

Table 1. Geochemical specific characteristics in districts of Tomsk region to maximum element concentration in pathologically changed thyroid glands (relative to regional monitoring)

protection of consumers and human welfare, Tomsk region [Zinchenko (1999)].

Calculation of the above-mentioned coefficient, which includes the sum of integrated factorial air pollution, drinking water, and soil contaminant coefficients, which, in their turn, are determined in accordance to method recommendations N 01-19/17-17 (1996), resulted in the division of districts into groups with different degrees of hygiene and sanitary welfare [Zinchenko (1999)].

One should take note of the fact that some districts are immediately close to mega-enterprises which are located in the proximity of Tomsk (such districts as Asinovsk, Teguldetsk, Tomsk, as well as, Pervomajsk and Zirjansk); Parabelsk, with its intensive oil and gas recovery, and zones of falling detached missile parts.

According to the hygiene ranking of the territorial region to degree of sanitary-hygiene intensity conditions, and based on method recommendations of State Committee in Sanitary-Epidemic Inspection (N 01-19/17-17, 1996), the following five district groups were highlighted (Fig. 13). The territories with maximum unfavorable environment are Tomsk, Asinovsk, Pervomajsk and administratative districts in Parabelsk [Zinchenko (1999)].

According to the following scientists, N.V. Vasilev, A.P. Vorobjeva, I.I. Balashova, and others, the existence of anomalous biochemical areas on the territories of Tomsk region is due to the development of specific diseases (for example, leukemia, and others). Thus, research data on the determining characteristic distribution of nosologic forms of thyroid gland diseases [Baranovskaya et al (2006)] indicated that these diseases are located in highly unfavorable areas of ecological coefficients (Table 2). At the same time, their spatial localization distinctly indicates maximum ecological unfavorable zones, for example, north-southern part of Tomsk district (Fig.14). This can be also stated with regard to other disease types

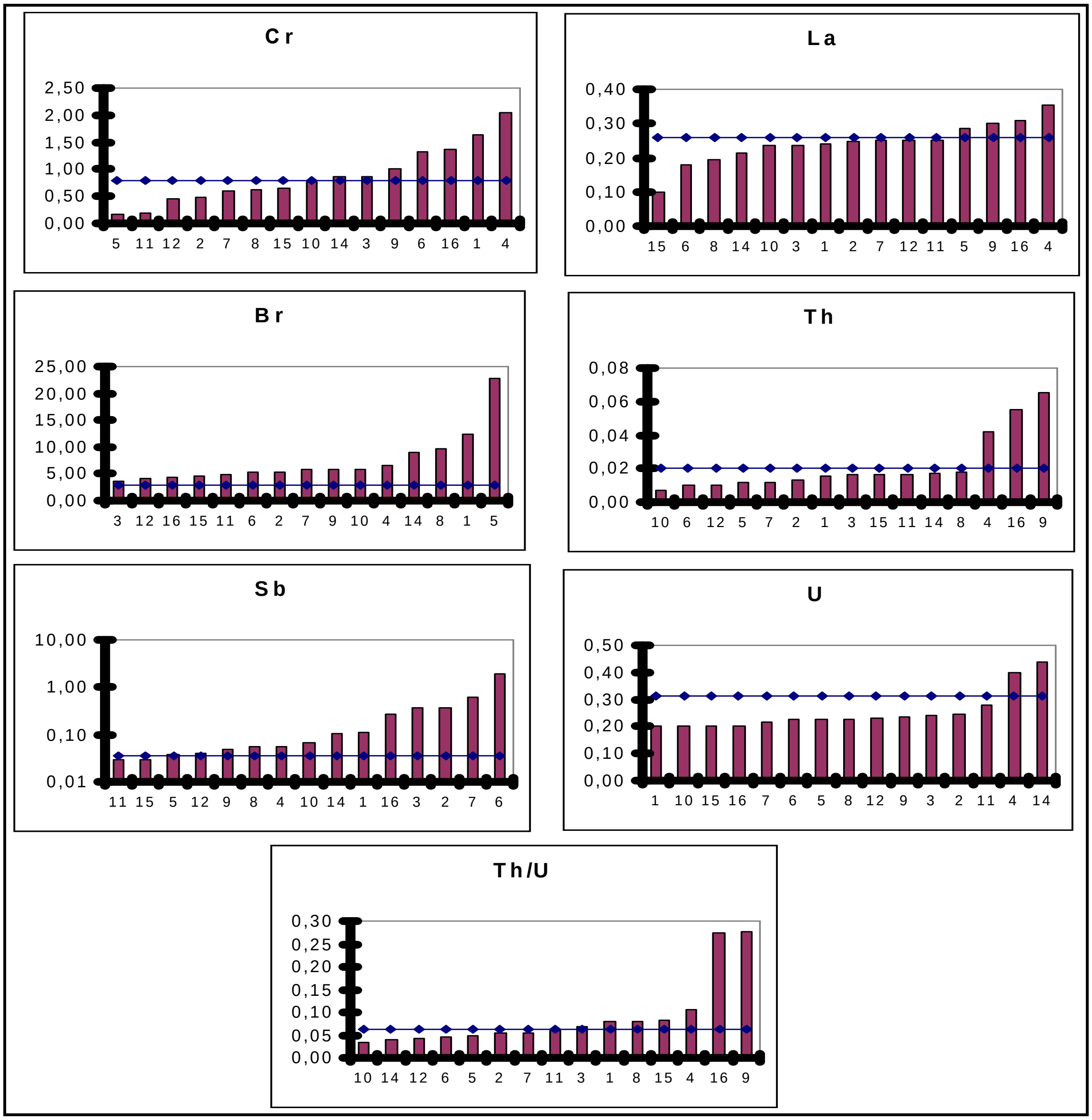

Figure 10. Ranking districts in Tomsk region according to content of several micro-elements (mg/kg) and Th/U ratio in human thyroid glands

[Sukhikh (2005), Rikhvanov et al (2006)].

In conclusion, all the research data is considered to be under evaluation and preliminary, as the amount of data is insufficient to obtain more reliable coefficients, excluding only the data for Tomsk district [Rikhvanov et al (2006)]. However, the above-mentioned research results highlight the existing problem and indicate the necessity of an integrated ecological-geochemical monitoring of the Tomsk regional environment, which in its turn, significantly influences the population welfare and health as observed in the Tomsk district [Sukhikh (2005), Rikhvanov et al (2006)] and other districts of Tomsk region [Zinchenko et al (1999)].

This paper can be considered as the quantitative evaluation basis for potential population health risk of Tomsk region with respect to the natural environment quality including numerous factors, termed as «quality». The next research stage is risk identification [Scherbo (2002)].

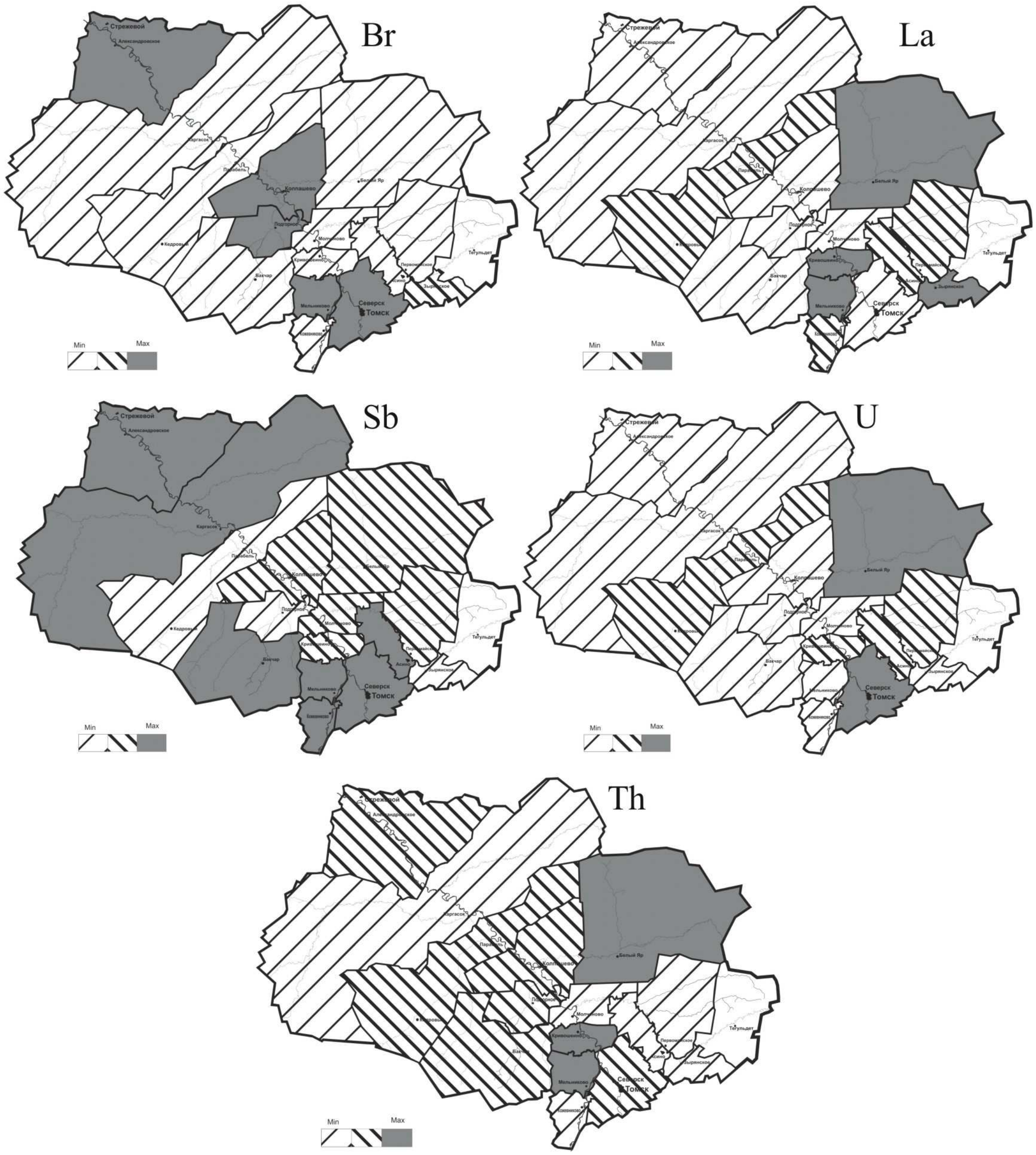

Figure 11. Spatial value distribution of human thyroid gland concentration coefficients relative to regional norms in districts of Tomsk region

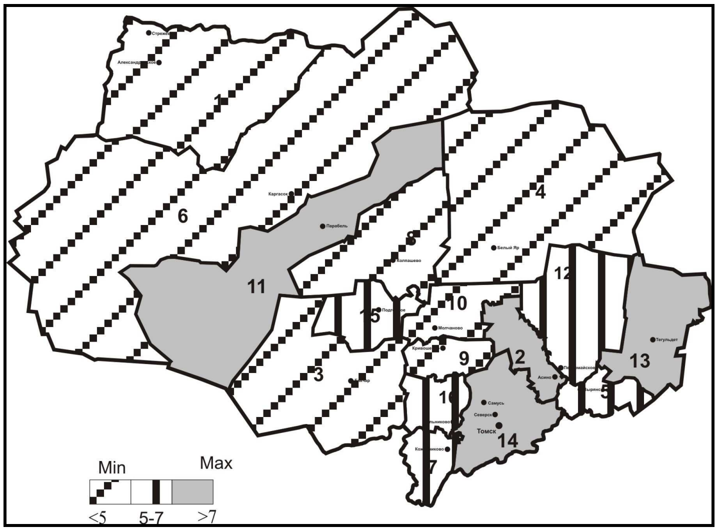

Figure 12. Schematic map of Tomsk region in accordance to integrated contaminant environment coefficient [Zinchenko (1999)]

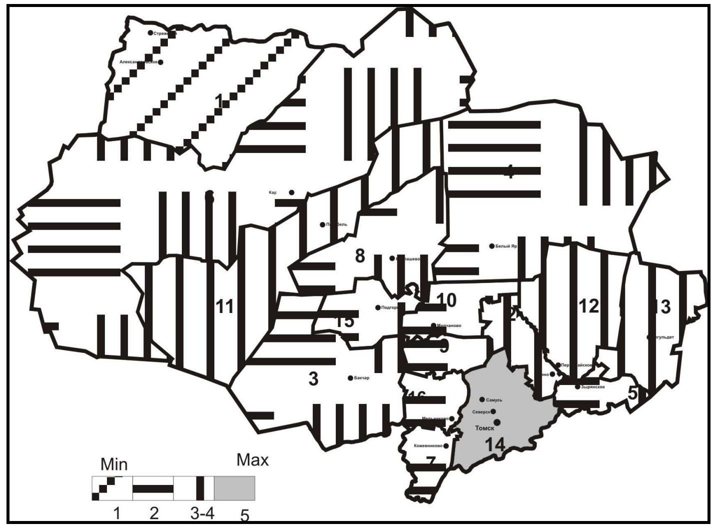

Figure 13. Distribution of districts in Tomsk region to degree of sanitary-hygiene intensity conditions [Zinchenko (1999)]

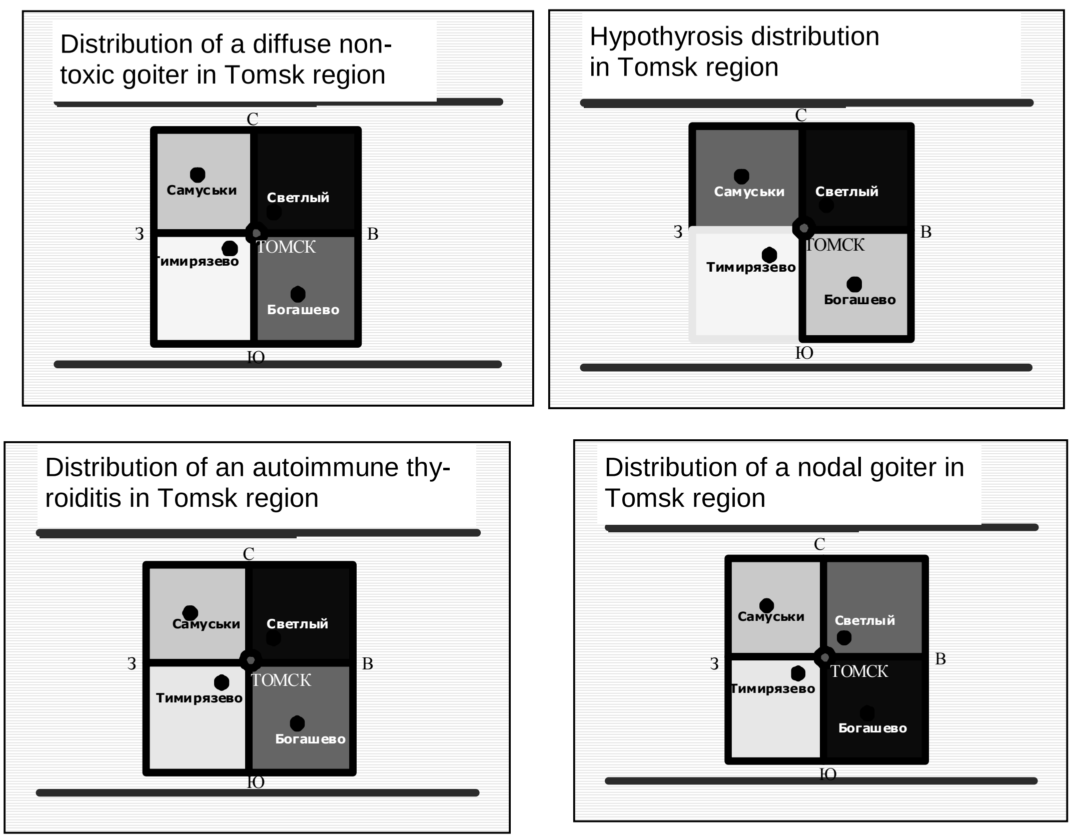

Figure 14 Thyroid gland pathology in districts of Tomsk region (intensive grey color indicates the corresponding thyroid gland pathology level) Quadrants NW, SW, SE, NE around the city of Tomsk.

№	Districts in Tomsk region	1	2	3	4	5	6	7	8
		DTGE	NG	CAT	DTG	CTD	ATD	Cancer	Others
1	Aleksandrovsk	6,7	1,1	2,1	0,3	0	0,4	0	0,08
2	Asinovsk	37,7	1,2	14	0,5	0,07	2,5	0,07	0,3
3	Bakcharsk	22,9	2,5	3,7	0,3	0,1	1,2	**0,12**	0,18
4	Verneketsk	**65,7**	**5,1**	**8,6**	0,9	0,04	**3,3**	**0,13**	0,31
5	Zirjansk	**51,58**	**5,7**	**8,1**	**1,0**	0	1,9	0	0,23
6	Kargasoksk	23,1	4,4	4,5	0,6	**0,17**	2,4	0	**0,44**
7	Kozhevnikovsk	19,0	3,8	3,4	0,6	0,04	2,4	0,08	0,2
8	Kolpashevsk	20,4	4,9	4	0,6	0,04	1,7	0,04	**0,36**
9	Krivosheinsk	32,4	4,8	5,2	0,8	**0,22**	**2,9**	0,05	**0,38**
10	Molchanovsk	20,2	3,6	5,8	0,5	0,05	1,9	0	0,16
11	Parabelsk	**64,9**	**6,1**	**7,8**	0,2	0	**3,5**	0,05	**0,38**
12	Pervomaisk	30,9	4,0	5,8	0,6	0,04	1,7	0,09	0,21
13	Teguldetsk	41,3	3,9	5,2	0,3	0	2,2	0	0,11
14	Tomsk	**56,1**	**7,0**	**8,5**	0,7	0,09	**3,8**	**0,15**	**0,45**
15	Chainsk	**54,2**	**5,6**	6	0,7	**0,36**	**2,7**	0,06	0,24
16	Shegarsk	**52,2**	3,7	5,1	0,5	0,08	2,4	**0,13**	0,08
17	Average district value	38,6	4,9	6,2	0,6	0,08	2,5	0,1	0,3

Table 2 Different diseases of separate thyroid gland pathology types in districts of Tomsk region per 1000 persons (during 5 years)

Notes: 1 – diffuse thyroid gland enlargment (DTGE); 2 - nodular goiter (NG); 3 - chronic autoimmune thyroiditis (CAT); 4 - diffuse toxic goiter (DTG); 5 - congenital thyroid deficiency (CTD); 6 -acquired thyreoid deficiency (ATD); 7 - cancer; 8 – other diseases (acute, subacute thyroiditis and so on).

References

(All titles are only in Russian)

1. A.M. Adam et al, Evaluation of Contaminant Accumulation Level in Natural Environment Regions with Complex Technogenic Load. // Thesis from International Conference «Sibeko-93». Part 1. – Irkutsk, 1993. – pg. 28-29.
2. A.M. Adam, Theory and Methods Providing Ecological Safety of Technological Establishments and Territories for Stable Nature Management (in West Siberia) // Avtoref. Dissertation in Doctor of Geological-Mineralogical Sciences – Tomsk, 2006. – 38 pg.
3. A.M. Adam et al, Natural Resources and Economic Safety in West Siberia. –Moscow: Publ. House «NIA - Priroda», 2001. – 172 pgs.
4. A.M. Adam et al, Ecological Problems in Regions of Russia. Tomsk Region.// Informazhionni vipusk № 6. – Moscow: VINITI, 2000. – 190 pg.
5. Aerosols in Nature Surfaces of Siberia / A.P. Bojarkina, V.V. Baykovskii, N.V. Vasilev et al – Tomsk: Publ. House TSU, 1993. – 157 pg.
6. N.V. Baranovskaja et al. Role of Chemical Elements in the Thyroidal Pathology Development // Materials IV Scientific-Practical Conference «Heavy Metals and Radionuclide in the Environment». Vol.2. – Semipalatinsk, 2006. – pg. 13-25.
7. N.V. Baranovskaja. Element Composition of Biological Substances and its Application in Detecting Anthropogenic Changes Territories (example- southern part of Tomsk region) // Avtoref. Dissertation in Candidate of Biological Sciences – Tomsk, (Tomsk State University) TSU, 2003. – pg. 24.
8. V.M. Gavshin et al. Evidence of Chemical Element Fractionation in the Atmosphere of West Siberia According to Research Data of Upper Peat // Geokhimija, 2003, № 13, pg. 1337-1344.
9. U.P. Gichev. Environmental Pollution and Man's Health –Moscow – Novosibirsk, 2002. – 229 pg.

10. N.S. Zinchenko. Hygiene Norms- Basis of Sanitary- Epidemiological Welfare // Dissertation in Candidate of Medical Sciences – Moscow, 1999. – 21 pg.
11. G.G. Onischenko et al. Основы Risk Evaluation Fundamentals for Population Health Affected by Chemical Substances, Contaminant environment. – Moscow, 2002. – 408 pg.
12. B.A. Revich. Environment Contamination and Population Health. – Moscow: ZHEPR, 2001. – 212 pg.
13. B.A. Revich et al. Ecological Epidemiology– Moscow., 2004. – 379 pg.
14. L.P. Rikhvanov et al. Determination of Main Contamination Sources and Forecasting Population Health through Methods of Geochemical Environment Component Mapping // Materials IV Unified International Symposium in Applied Geochemistry Problems. – Irkutsk, 1994. – pg. 88-89.
15. L.P. Rikhvanov et al. Soil- Depositing Environment in Studying Technogenic Factor Impact on Nature // Problem of Regional Ecology. Regional Monitoring. Issue 3, 1994. – Tomsk, 1994. – pg. 35-46.
16. L.P. Rikhvanov et al. Preliminary Evaluation of Heavy Metal Accumulation Level in Ob River Basin // Prirodokompleks Tomsk Region. Vol.1. Geology and Ecology. – Tomsk: Publ. House TSU, 1995. – pg. 249-259.
17. L.P. Rikhvanov et al. Retrospective Evaluation of Radioactive Substances in the Environment // Materials of International Conference «Radioactivity after Explosions and Accidents. Vol.2. – St.-Petersburg, Gidrometeoizdat, 2006. – pg. 325-331.
18. L.P. Rikhvanov et al. Ecological- Geochemical Peculiarities in Tomsk Region and Diseases of the Population. – Tomsk, 2006. – 213 pg.
19. L.P. Rikhvanov, N.V. Baranovskaja, T.N. Ignatova. About Geochemistry of Living Substances. // Materials IV Scientific-Practical Conference «Heavy Metals and Radionuclide in the Environment). Vol.1. – Semipalatinsk, 2006. – pg. 19-40.
20. S.I. Sarnaev et al. Evaluation of Ecological Conditions in Seversk According to Geochemical Research Results of Natural Environment. // Prirodokompleks Tomsk Region. Vol.1. Geology and Ecology. – Tomsk: Publ. House TSU, 1995. – pg. 224-231.
21. U.I. Sukhikh. Hygiene Aspects of Population Health under Anthropogenic Environment Contamination Conditions (Tomsk Region) //Aftoref. Dissertation in Candidate of Medical Sciences – Moscow, 2005. – 24 pg.
22. A.U. Shatilov. Substance Composition and Geochemical Characteristics of Atmosphere Precipitates in Ob River Basin Territory. // Aftoref. Dissertation in Candidate of Geological-Mineralogical Sciences. – Tomsk, 2001. – 24 pg.
23. A.P.Scherbo. Environment and Health: Approaches Determining Risk Evaluation. – St. Petersburg: MAPO, 2002. – 376 pg.
24. E.G.Yazikov et al. Detecting Role of Salt Formations in Water during Geochemical Monitoring // Izv. VUZov. Geology and Survey, № 1, 204. – pg. 67-69.
25. E.G.Yazikov. Ecologic-chemical urbanization of south – west Siberian territories. // Avtoref. Dissertation in Doctor of Geological-Mineralogical Sciences –Tomsk, 2006. – 48 pg.

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