July 2006

MEDICAL GEOLOGY NEWSLETTER

International Medical Geology Association

Newsletter No. 9
ISSN 1651-5250

IMGA MEMBERSHIP INFORMATION AT
http://www.medicalgeology.org/IAMG.htm

DUES REMINDER

CATEGORY 1 COUNTRY MEMBERS

See P. 23 for information on how to pay your dues.

Inside this issue:

Message from the Directors 2

UK Research Councils New Environment and Health Programme 3

Letter to the Editor: Geoscience Philosophy 4

Dangerous Gas in the Jubarkas District, Lituania 5

International Year of Planet Earth 7

International Symposium on Medical Geology, Stockholm, Index to Abstracts, P 11 –23 10

Postgraduate Training in Medical Geology, Univ. of Western Australia 18

Geohealth and Medical Geology Listserve 22

A MEDICAL GEOLOGY COURSE IN THE AMAZON REGION See P. 8

MESSAGE FROM THE DIRECTORS

Interest in Medical Geology continues to expand worldwide at an increasingly rapid rate, creating numerous opportunities. Therefore we launched the International Medical Geology Association (IMGA) in January of this year. This is the first regular newsletter of IMGA and our plans are to send you two newsletters like this every year. But we rely on your help and we hope that you will submit material for the newsletters.

Olle Selinus continues in his capacity as Director of this activity. Jose Centeno and Bob Finkelman are Co-Directors. Dave Elliott will continue his work as editor of the Newsletter

Secretary of IMGA is Kim Chisholm, University of Western Australia, Australia, Treasurer is Dave Slaney, New Zealand. We have also appointed six Councilors to represent the broad geographic distribution of Medical Geology and the wide range of disciplines that are embraced by this topic.

The Councilors are:

Bernardino Ribeiro de Figueiredo (Geologist, Brazil)

Fiona Fordyce (Geochemist, UK)

Zheng Baoshan (Geochemist- China).

Calin Tatu (Medical researcher, Romania)

Nomathemba Ndiweni (Veterinary Biochemistry, Zimbabwe)

Philip Weinstein (Epidemiologist, Australia)

We are very pleased that such experienced and competent people are willing to devote their time and efforts on behalf of the Association.

As part of the benefits of our membership at the IMGA, the Association can offer the book ***Essentials of Medical Geology*** with a 30% discount for those IMGA members in good standing. Please contact the secretary of IMGA, Kim Chisholm on this and she will arrange it.

What has happened so far this year?

- We have asked several people to organise the regional divisions of IMGA. The following divisions are under planning: South America, Caribbean and Central America, Sub-Saharan Africa, SE Asia including India, Sri Lanka etc, East Asia, Australia, Oceania, Russia and NIS, North America, Europe, Southern Mediterranean.
- The First Hemispherical Conference on Medical Geology was held on November 14-18, 2005 in Puerto Rico with the participation of countries from the Caribbean Basin as well as South America and the US. The 2nd Hemispherical Conference on Medical Geology is planned for October 2007, and it will be held in Brazil. More information on this conference will be posted on the IMGA website.
- We have had two short courses in Portugal, one international symposium in Stockholm organised by the Royal Academy of Sciences, several keynote lectures and special sessions at medical and geo-science conferences.
- The book ***Essentials of Medical Geology*** has received two outstanding awards from the medical profession and the geological/geographical profession as one of the best books published last year.
- We can now offer the book to all members with a 30% discount.
- The new logotype of IMGA is in its final stage and will be ready before summer.
- The website will soon be updated to reflect the new IMGA.
- Education has started at universities in Australia, US and Sweden. Please send us information on all new university courses so we can add them to the website.

For all new information, please look at the website regularly.

Olle Selinus Bob Finkelman Jose Centeno

UK RESEARCH COUNCILS ANNOUNCE NEW ENVIRONMENT AND HUMAN HEALTH PROGRAMME, Fiona Fordyce, British Geological Survey, UK

Five of the main Research Councils in the United Kingdom recently announced a joint initiative on Environment and Human Health. The new Programme will run for three years and focus on capacity building in this sector. As such, the Programme will support activities such as inter-disciplinary networking, workshops, working groups and fellowships.

The Programme is supported by the Biotechnology and Biological Sciences (BBSRC), Engineering and Physical Sciences (EPSRC), Economic and Social (ESRC), Medical (MRC) and Natural Environment (NERC) Research Councils in addition to the UK government Environment Agency (EA) and Department for Rural Affairs (DEFRA) and the Wellcome Trust Medical Charity.

In the first instance the Programme will identify and prioritise research areas and develop the research groupings needed to address the inter-disciplinary and often multi-factorial issues of concern at national and international levels. The aim of the Programme is to improve the health of people both in the UK and globally by providing a forum for inter-disciplinary work; increase knowledge and understanding of the links between environment and human health; provide an evidence-base for risk assessment and regulation and allow better prediction of emerging issues in the future.

The supporting partners are currently working to establish the Programme, which will be overseen by a Scientific Advisory Committee. Initial consultation exercises identified four main research themes – *Pathogens* and *Pollutants* (chemicals and particles) and the *Pathways* these follow and their interaction with *People*.

The *Pathogens* theme is likely to consider issues such as global environmental change and vector or parasite range and abundance; changes in microbial communities such as the evolution of antibiotic resistance; quantifying the survival and persistence of pathogens in the environment, particularly in the absence of disease; emerging diseases and new vectors and better understanding of vector ecology using post-genomic techniques.

The *Pollutants* theme will address concerns such as the active features of particles that cause problems, be it surface properties, size, shape and composition; interactions of mixtures of chemicals in the environment, including the potential for synergistic effects and exposure to chemical cocktails; chronic low-level exposure to toxins, including intergenerational effects and the long-term effects of pollutants; assessment of toxicology and exposure (including nanoparticles) and improved analytical methods.

The *Pathways* theme will investigate the transfer mechanisms of substances (pathogens, pollutants, natural materials) from the environment into the body and their toxicity and function in the body.

The *People* theme will consider the role of factors such as socio-economic status, age, gender, disability, illness and the implications for resilience, adaptive capacity, shaping behaviours and managing environmental health risks. This theme will also investigate the impact on environment-health interactions of major global trends, for example, in trade, urbanisation and population change, as well as the economic and social costs of environmental impacts on health and the benefits of the environment.

This theme will incorporate the differing perceptions of risk and attitudes and enhancing public engagement and dialogue about environment and health issues.

More information about the Programme is available at the web site:

www.nerc.ac.uk/funding/thematics/envhh

LETTER TO THE EDITOR: Geoscience Philosophy, Dr Karl Wolf

Medical Geology, like all other sciences, could benefit by occasional 'softer' philosophical deliberations which may eventually have an impact on the 'harder' aspects of our numerous earth sciences' sub-disciplines. Allow me to deal with at least three aspects, namely Medical Geology (1) is a systems or cybernetic science; (2) could deal with military problems so far ignored; and (3) ought to examine some controversial scientific enigmas. None of these can be discussed in detail, but a few comments may be of interest.

(1) Implicitly the name Medical Geology (MG hereafter) utilizes all the basic and derived sciences, but also many of the humanities, by combining any philosophies, data bases, methodologies, techniques, …, to tackle a specific problem. Thus, MG employs a holistic (or if you wish near-synonyms integrative, systems analytical, synergetic, cybernetic, …) approach.

I highly recommend two *Encyclopaedias* which are of invaluable assistance in the research of any human/social and natural, often seemingly intractable, system -- including, of course, MG complexes. The publications are (with references to some of our reviews):

--Union of International Associations, 1995 (4th Edition). ***Encyclopaedia of World Problems and Human Potential, Volumes 1, 2 & 3.*** K.G. Saur Publishers, Munich, London, 3,161pp. ISBN 3-598-11165-7. (See reviews in Journal of Documentation, 1998, v. 54, no. 4, 520-523; Contemporary Psychology, 1998, v.43, no. 9. 604-606; and Social Behaviour & Personality, 1998, v. 26, no. 4, 407-408.)

--Franćois, Charles, 2004 (2nd edition). ***International Encyclopaedia of Systems and Cybernetics***. K.G. Saur Publishers, Munich, London, 741pp. ISBN 3-598-11630-6. (See review in The Australian Geologist Newsletter No. 134, March 30, '005, p. 49-50.)

(2) There is no need to point out that during military peace-time exercises as well as during war-time operations the three forces may be exposed to human-concocted and natural situation that demonstrate a relationship between geology/geography, on one hand, and health/medical conditions, on the other. Yet, how much has been investigated and written about these links? However, I do know about several books related to Military Geology/Geography *per se* which have poorly or not at all dealt with this specific military problem.

So, here is another book that is recommended, although a supplementary essay may eventually have to take care of the health/medical part:

--Caldwell, D.R. et al., 2004. ***Studies of Military Geography and Geology***. Kluwer/Springer Verlag, Heidelberg, New York, London, 348pp. ISBN 1-4020-3104-1.

(3) As to a rather geological/geographical health problem which has been studied on several continents for many years by the British Purdey brothers, I believe that our M.G. (e.g. geochemists, pedologists) fraternity ought to pick this as a research topic – although many skeptics exist.

To start with see The Environmental Home Page: www.purdeyenvironment.com/

'exploring the Environment which may be causing a wide variety of diseases such as BSE, CJD, scapie, prions, Parkinsons & Alzheimer's diseases, autism, the Chronic Fatigue Syndromes, and many more through pesticides, industrial pollutants, metals – as found in soils and water'. Many links provide a huge amount of data as well as discussions!

Comments are very welcome. Any questions will be answered immediately. Contact me.

Dr. Karl H. Wolf

Emeritus Professor of Geology

wolfwisdom@bigpond.com.au

AN INVESTIGATION OF DANGEROUS GAS IN THE JUBARKAS DISTRICT OF LITHUANIA.

A. Bitinas, A. Jusiene, R. Seckus, J. Satkunas, Geological Survey of Lithuania, Konarskio 35, Vilnius LT 03123,e-mail: jonas.satkunas@lgt.lt

Two people died in the Vajotai village of the Jurbarkas region (South-Western Lithuania, Fig. 1) due to effusion of gas into a dug well August 14, 2003 (Fig. 2). A similar case (one person perished in the well) was reported from the same village several years ago. Intoxication by methane gas was supposed to be the reason in both cases. Therefore specific geological interest was put into this locality during the regular state mapping of Quaternary deposits at a scale of 1:50 000 in the Jurbarkas region.

In cooperation between the Geological Survey of Lithuania and the Jurbarkas municipality, detailed geological investigations have been carried out in the vicinity of Vajotai village in 2004. Geophysical investigations and drilling of 5 boreholes with measurements of gas composition and concentrations as well as detailed surficial geological and geomorphological studies of an area about 30 km^2 has been done. Analyses carried out by the labour hygiene control authority indicated that the deadly gas was carbon monoxide.

It has been appreciated that the region of Vajotai and a few neighboring villages as well as their nearest surroundings are favorable for accumulation of carbon monoxide. A Quaternary intermorainic semi-filled aquifer filled by sandy sediments at a depth of about 10-15 meters was the source of gas. The gas pressure in the sandy layer has direct correlation with water level fluctuations in the aquifer (Fig. 3). Drillholes are the most reliable way to detect the gas. The natural source of carbon monoxide could be estimated after detailed geological investigations.

The geological report prepared for Jurbarkas municipality presents the possible localization of accumulation of the dangerous gas, the principal geological model of gas migration as well as

Fig. 1. Area of investigations indicated by a star.

Fig. 2. The site of the dug well where the fatal accident happened.

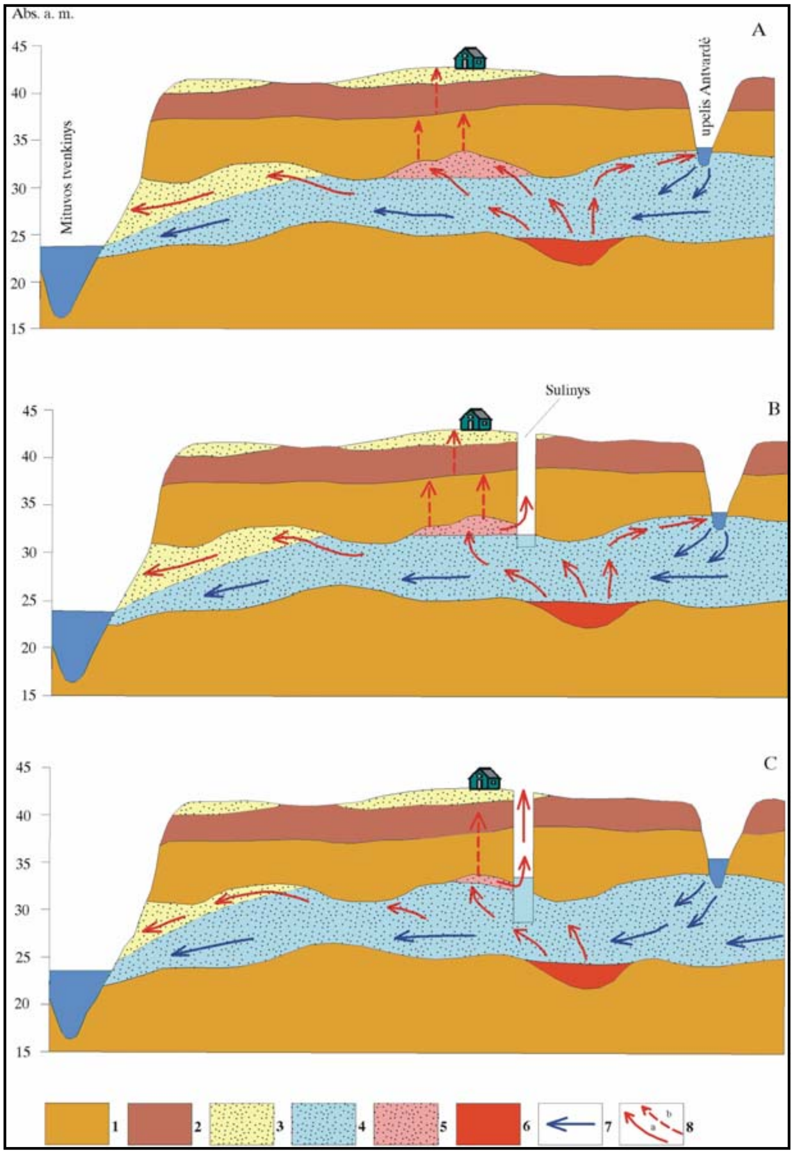


Fig. 3. The principal scheme of migration and concentration of carbon monoxide.

Key

1 – morainic sandy loam and clayey loam (till)
2 – clay. Sandy deposits
3 – dry
4 – aqueous
5 – saturated by gas
6 – supposed source of carbon monoxide
7 – direction of groundwater flow
8 – migration of gas (a – intensive, b – slow-motion).

THE INTERNATIONAL YEAR OF PLANET EARTH 2007-2009 – EARTH SCIENCES FOR SOCIETY: A BRIEF STATUS REPORT. Prof. Edward Derbyshire, Chair, Science Programme Committee

The International Year of Planet Earth was launched in 2000 by the IUGS, later to be joined by UNESCO's Earth Science Division, making it a joint IUGS-UNESCO initiative. The process culminated on 22 December 2005, when the UN General Assembly in New York proclaimed the year 2008 as the International Year of Planet Earth. This will form the core year of a triennial programme running from January 2007 to December 2009. The Year is led by Dr. Eduardo de Mulder (The Netherlands).

The UN's Press Release reads as follows:

"By a draft on the International Year of Planet Earth, 2008, which the Committee approved without a vote on 11 November, the Assembly would declare 2008 the International Year of Planet Earth. It would also designate the United Nations Educational, Scientific and Cultural Organization (UNESCO) to organize activities to be undertaken during the Year, in collaboration with UNEP and other relevant United Nations bodies, the International Union of Geological Sciences and other Earth sciences societies and groups throughout the world. Also by that draft, the Assembly would encourage Member States, the United Nations system and other actors to use the Year to increase awareness of the importance of Earth sciences in achieving sustainable development and promoting local, national, regional and international action,"

The operational framework of the Year's Science Programme Committee (SPC) will consist of 10 broad Themes: Groundwater, Climate, Earth and Health, Deep Earth, Megacities, Resources, Hazards, Ocean, Soil and Earth & Life. Science Theme brochures are available in both printed and electronic forms, and may be downloaded from the Year's website - www.yearofplanetearth.org. The SPC is chaired by Professor Edward Derbyshire (University of London).

Both Expressions of Interest and Project proposals will be assessed by the 10 Science Implementation Teams appointed by the Board (the main governing body of the Year).

The Year's Outreach Programme Committee (OPC) has developed the website produced flyers, and released many thousands of general information brochures and leaflets. Like the Science Programme, it will essentially operate in 'bottom-up' mode, but individuals and organisations may be invited to submit proposals for realization through the Year. The OPC is chaired by Dr. Ted Nield (Geological Society of London).

Implementation of the Outreach Programme will be undertaken largely at regional and local levels. Countries and regions will be encouraged to develop their own outreach programmes. Components of the Outreach Programme may include:

- Cooperation for increased visibility: affiliate with the Year
- Recycling educational material
- Support scientists from countries with weak economies
- Citizen science: involve the public in research
- Competitions
- Stories (news, books)
- Programme making
- Art commissioning

An Outreach brochure, inviting individuals and organisations to propose outreach projects, is available both in printed form and on the website. In addition, flyers on the essentials of the International Year of Planet Earth have been produced and printed in English, French, Arabic, Russian, German and Spanish.

Advisory Groups include Senior Advisers (of which there are currently 46) and a small number of distinguished individuals acting as Goodwill Ambassadors.

Institutional geoscientific support is provided by 12 Founding Partner organizations, which include a range of sister scientific unions. Some 26 other similar organizations act as Associate Partners. Partnership remains open to more such organizations.

Political support for the Year came from 97 countries prior to the UN proclamation by all 191 of its member states.

Links with other ventures have been forged, and notably include three other Earth-related international year initiatives: the International Polar Year (IPY), the electronic Geophysical Year (*e*GY) and the International Heliophysical Year (IHY). Agreements on cooperation and partnership include the 'Celimontana Declaration', issued in October 2005, which focuses in timely fashion on all four programmes coinciding with the 50th anniversary of the IGY.

National Committees are expected to play a key role in the implementation of the Year's programmes on both international and national levels. National Committees of the Year of Planet Earth have been launched, or are in process of being set up around the world (see figure on page 9).

National Committee establishment, as at 21 May 2006

Attainment of the aims and objectives of the Year will depend upon attracting substantial financial income from a variety of sources around the world. Contributions allocated so far to the budget during the *Feasibility and Preparatory Phases* of the International Year of Planet Earth totalled over $400,000.

Implementation of the International Year is predicated on the successful raising of at least US$ 20 million, which will be roughly equally divided between the Science and Outreach programmes. A total sum of US$5 million is regarded as a minimal target budget. The private sector (both multinational and national/regional/local private companies), and multinational intergovernmental institutions (donor organizations such as development banks and science organizations) are expected to provide the bulk of the support.

Fund-raising is now under way, following UN-proclamation and establishment of the Year as a not-for-profit Corporation. Further details of budgets and business policy, etc., may be seen in the Business Plan on the Year's website.

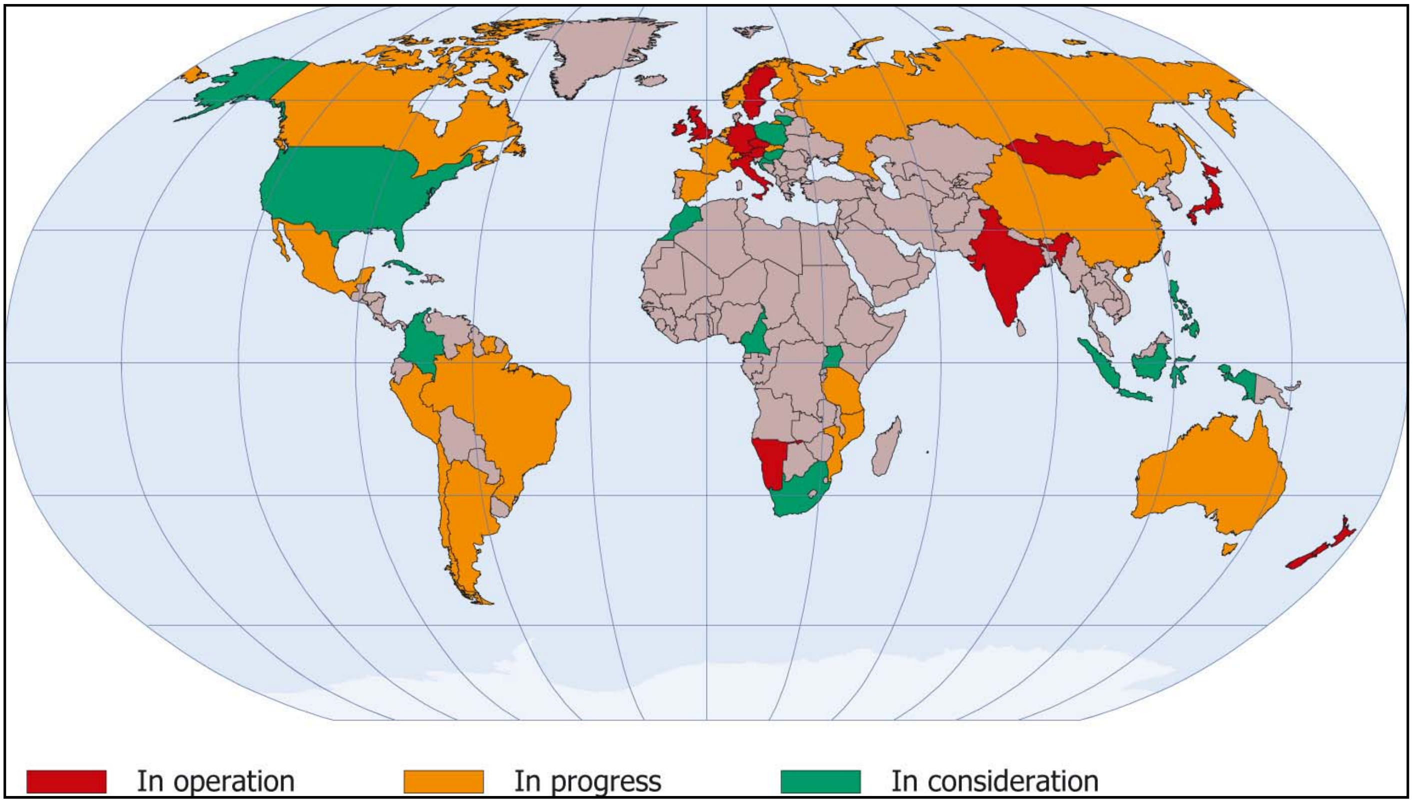
Members of the IMGA will be particularly interested in the "Earth and Health" Theme of the International Year. It is expected that the Science Implementation Team for this Theme will be finalized by the end of June 2006. It will work under the leadership of Dr. Olle Selinus (Geological Survey of Sweden). IMGA members are invited to examine the "Earth and Health" brochure online at www.yearofplanetearth.org.

Edward Derbyshire, Chair, Science Programme Committee International Year of Planet Earth 2007-2009

MEDICAL GEOLOGY IN THE AMAZON REGION (See photo on cover page)

For the very first time a short course on Medical Geology was offered in the Amazon Region last March, in connection with the 9th Amazonian Geological Symposium held in Belém (State of Pará, Brazil). The one-day course was entitled "Geology, Environment and Health" and was conducted by Dr. Bernardino R. Figueiredo from the University of Campinas and Dr. Rômulo S. Angélica from the Federal University of Pará. Most of the 20 participants were students and academics from the three geological courses in the Brazilian Amazon Region. Dr. Figueiredo was also invited to address the participants of the Symposium with a conference entitled "Mining and Public Health: the case of arsenic

THE INTERNATIONAL YEAR OF PLANET EARTH 2007-2009 Cont.



International Year of Planet Earth, National Committee establishment, as at 21 May 2006

MORE NEWS ABOUT IMGA

- About 250 registered members, abut 50% of these in Category 1 countries
- 2 Corporate members, one in Norway and one in Sweden
- Dues structure varies with country see http://www.medicalgeology.org/IAMG.htm for details.
- Planned Short courses and Conferences:
  - 2006
    - Beijing China
    - Albuqueque – August 2006
    - Bangladesh – November 2006
  - 2007
    - Indonesia 2007 – Year of Planet Earth
    - Brazil Oct 2007 – 2nd Hemispheric Conference of Medical Geology
    - Ecology/Geology June 2007 – Kruger National Park, South Africa
  - 2008
    - Oslo 2008 - International Geological Congress

THE INTERNATIONAL SYMPOSIUM ON MEDICAL GEOLOGY 18–19 MAY 2006, STOCKHOLM UNIVERSITY

Attendees at the Symposium, held under the auspices of the Royal Swedish Academy of Science.

KUNGL. VETENSKAPSAKADEMIEN
THE ROYAL SWEDISH ACADEMY OF SCIENCES

INDEX TO ABSTRACTS ON PAGES 11 TO 23

Epidemiological Transitions and the Changing Face of Medical Geology, Prof. Philip Weinstein 11

Iodine Deficiency, an Ancient Problem in a Modern World, Prof. Ron Fuge 11

Flourides and Human Health, Dr. Chandra Dissanayake 12

Natural Mineral Dust: Sources, Pathways, Toxins and some Health Impacts, Prof. Edward Derbyshire 13

Blackfoot Disease and Arsenic: A Never-ending Story, Prof. Chin-Hsiao Tseng 13

Global Impacts of Geogenic Arsenic – A Medical Geology Research Case, Dr. Jose A. Centeno 14

Health Effects of Arsenic in Drinking Water, Prof.Marie Vahter 15

Radon in Air and Water, Dr. James Donald Appleton 16

Selenium Deficiency and Endemic Heart Failure in China, Prof. Changsheng Li 17

Selenium Geochemistry and Health, Dr. Fiona Fordyce 18

Health Effects of Toxic Organis Substances from Coal: Pandemic Nephropathy, Dr. William Orem 19

Health Impacts of Coal: Facts and Fallacies, Dr. Robert B. Finkelman 20

Metal Biology – Aspects of Beneficial Effects, Prof. Ulf Lindh 21

Mobilisation and Environmental Cycling of Mercury, Dr. John Munthe 22

Medical Geology – An Opportunity for the Future, Dr. Olle Selinus 23

ABSTRACTS FROM THE INTERNATIONAL SYMPOSIUM ON MEDICAL GEOLOGY 18–19 MAY 2006, STOCKHOLM UNIVERSITY

EPIDEMIOLOGICAL TRANSITIONS AND THE CHANGING FACE OF MEDICAL GEOLOGY

Prof. Philip Weinstein, School of Population Health, University of Western Australia.
Philip.Weinstein@uwa.edu.au

The relationship between our geological environment and our health predates current public health practice by at least 200,000 years, when the first modern humans appeared. Since that emergence of *Homo sapiens* in Africa, our species has undergone three epidemiological transitions, major changes in the pattern of our disease burden that result from steps in cultural evolution. Thus the advent in turn, of agriculture, industrialization, and globalization, has led to the emergence of a succession of new exposures to geogenic hazards and their associated disease patterns. Many of the public health challenges being thrown at us by the current epidemiological transition can only be solved by collaborative, multidisciplinary approaches, highlighting the importance of medical geology as an emerging science.

IODINE DEFICIENCY, AN ANCIENT PROBLEM IN A MODERN WORLD,

Prof. Ron Fuge, Institute of Geography and Earth Sciences, University of Wales, UK. rrf@aber.ac.uk

Endemic goitre and cretinism have been described for several millennia with reports suggesting that they were recognised and treated with burnt seaweeds and sponges, subsequently found to be enriched in iodine, as early as the 3rd Millennium BC. After the discovery of iodine in the mid-19th century it was soon realised that the diseases of endemic goitre and endemic cretinism were caused by iodine deficiency, being the most severe of a group of diseases collectively known as Iodine Deficiency Disorders (IDD). Despite the early recognition of the essentiality of iodine, however, it is a sad fact that IDD are still prevalent in the modern world, it being estimated that as much as 30% of the world population are at risk. The general view of IDD has been coloured by long held views on iodine geochemistry, which have recently been called into question.

Iodine in soils is derived mainly from the oceans, the largest terrestrial reservoir of iodine, through volatilisation and subsequent deposition, with little deriving from weathering of the lithosphere; this makes iodine unique amongst the elements. The general distribution of IDD were shown in early studies to be concentrated in areas remote from marine influence such as central continental regions, thus reflecting this aspect of iodine geochemistry. Thus it was held that populations living in areas which are subject to maritime influence are likely to be at little risk. However, the maritime influence on iodine distribution in soils has been shown recently to be more limited than originally thought, with soils from in excess of about 80 – 100 km from coasts containing similar iodine contents to those of central continental areas.

It has long been thought that populations living in areas with iodine-rich soils are not at risk of IDD, it being suggested that crops grown in these areas will provide sufficient iodine. However, it is unlikely that much iodine is taken up through the root system as both the iodide (I^-) and iodate (IO_3) anions have large ionic radii. It is more likely that elemental iodine absorption through the leaves represents the major pathway into plants. In general terms plants represent a poor source of dietary iodine, indeed it has been shown that strict vegetarian diets are iodine-deficient, with vegetarians being “a high risk“ group with regard to IDD.

FLOURIDES AND HUMAN HEALTH,

Dr. Chandra Dissanayake, Department of Geology, University of Peradeniya, Peradeniya, Sri Lanka

Even though the essentiality of fluoride for human health is accepted , its toxicity has now caused considerable concern in many lands where fluoride is found in excessive quantities in the drinking water. As in the case of some essential trace elements , the optimum range of fluoride varies within a narrow range causing fluoride imbalances, very often in large populations in developing countries of the tropical belt.

Fluoride is the most electronegative and chemically reactive of all halides. It is highly reactive with practically all organic and inorganic substances, occurring in the natural environment as the fluoride ion. It is found as a component in over 80 minerals, mostly in the silicate minerals of the earth's crust at an average concentration of about 650 ppm. Even though fluoride is found in food, water and air, much of the fluoride entering the human body however, is from water and the hydrogeochemistry of fluoride in surface and groundwater is therefore of major importance, particularly to developing countries of the tropical regions.

The link between fluoride geochemistry in water in an area and the incidence of dental and skeletal fluorosis is a well established relationship in medical geochemistry. Children under the age of 7 are particularly vulnerable to dental fluorosis which causes the teeth to change colour from white to yellow and dark brown with deep mottling.

If the ingestion of fluoride in excessive concentrations (generally over 5 mg/l) occurs for prolonged periods, skeletal fluorosis sets in, which affects men and women of all ages. There is an accumulation of fluoride in the skeletal tissues with consequent pathological bone formation. Among the notable symptoms observed are histological changes, increase of bone density, bone morphometric changes and crippling fluorosis. Even though dental fluorosis is easily detected due to the mottled and brown appearance of the teeth, skeletal fluorosis is not easily recognizable and one needs additional information from radiology. Paralysis often results due to the constriction of the vertebral canal with consequent pressure on nerves.

Fluoride is known to cause a series of disorders and aggravate many others interacting with the functions of many tissue systems and metabolic processes. Interference with the hydrogen bonds between biomolecules is known to occur when there is a high concentration of fluorides in the human body. Kidneys and the digestive system are particularly susceptible to diseases caused by the excess of fluoride within the body.

Geochemically, there are some areas in the world, notably in the tropical belt where groundwater contains excessive concentrations of fluorides. The presence of a high abundance of fluoride-bearing minerals and the easy exchange of the fluoride ion with the hydroxyl ion causes the enrichment of aqueous fluoride. Hydrogeochemical maps are therefore of great use to such countries.

MEMBERS DISCOUNT ON "ESSENTIALS OF MEDICAL GEOLOGY"

We can now offer the book, Essentials of Medical Geology, with a 30% discount to members of IMGA. Contact IMGA Secretary, Kim Chisholm, for details.

NATURAL MINERAL DUST: SOURCES, PATHWAYS, TOXINS AND SOME HEALTH IMPACTS, Prof. Edward Derbyshire, Centre for Quaternary Research, Royal Holloway, University of London, U.K.

Fine atmospheric dust, including mineral aggregates, fibrous minerals and organic fibres, may reach concentrations sufficient to affect human and animal health. Generation of dust particles results from several natural earth-surface processes. Entrainment by the wind (deflation) of silt (2 – 63 microns), together with silt-size aggregates made up of clay-size particles (<2 micron), is widespread in the world's drylands. The finer, respirable particles may be transported several thousand km. Solid aerosols are of concern in several scientific fields, including respiratory medicine, epidemiology and environmental biology. Deposition of solid aerosols in human pulmonary alveoli varies with several factors, but fine particle size and angularity, the chemistry of particle surfaces, and certain lung function parameters are particularly important. Very fine-grained free silica is of particular concern because of its role in the initiation of fibrosis and more advanced medical conditions, notably incurable and progressive non-industrial silicosis. Some outcomes of high levels of ambient dust will be described from central and eastern Asia. Several millions of the world's people are at risk, with domestic conditions and certain agricultural practices exacerbating the situation. Case studies related to dust storms in China, Ladakh, the Middle East, western United States and elsewhere will be described.

BLACKFOOT DISEASE AND ARSENIC: A NEVER-ENDING STORY, Prof. Chin-Hsiao Tseng , Division of Endocrinology and Metabolism, Dept. of Internal Medicine, National Taiwan University Hospital; National Taiwan University College of Medicine; School of Public Health, Taipei Medical University, Taiwan; and Division of Environmental Health and Occupational Medicine of the National Health Research Institutes, Taipei Taiwan

"Blackfoot disease (BFD)" is an endemic peripheral vascular disease confined to the southwestern coast of Taiwan. The epidemiology, clinical manifestations and diagnosis, pathology, etiology, and pathogenesis of this disease will be discussed. Sporadic cases of BFD occurred as early as in the early 20th century and peak incidence was noted between 1956 and 1960, with prevalence rates ranged from 6.51 to 18.85 per 1,000 population in different villages. Typical clinical symptoms and signs of progressive arterial occlusion mainly found in the lower extremities, but in rare cases, the upper extremities might also be involved. Ulceration, gangrene and spontaneous or surgical amputation were a typical fate. An extensive pathological study concluded that 30% of the BFD patients had histologic lesions compatible with thromboangiitis obliterans and 70% showed changes of arteriosclerosis obliterans. Epidemiologic studies carried out since mid-20th century revealed that BFD was associated with the consumption of inorganic arsenic from the artesian wells. Recent studies confirmed the existence of preclinical peripheral vascular disease, subclinical arterial insufficiency and defects in cutaneous microcirculation in the residents of the endemic villages. A more recent study suggested that the methylation capacity of arsenic can interact with arsenic exposure in the development of peripheral vascular disease among residents of BFD-endemic areas. The incidence of BFD decreased dramatically after the implementation of tap water in these villages over the past 2-3 decades. The atherogenicity of arsenic could be associated with its effects of hypercoagulability, endothelial injury, smooth muscle cell proliferation, somatic mutation, oxidative stress, and apoptosis. However, its interaction with some trace elements and its association with hypertension and diabetes mellitus could also explain part of its higher risk of developing atherosclerosis. Although humic substances have also been suggested as a possible cause of BFD, epidemiologic studies are required to confirm its etiologic role.

GLOBAL IMPACTS OF GEOGENIC ARSENIC – A MEDICAL GEOLOGY RESEARCH CASE

DR. JOSE A. CENTENO[1,*], Robert B. Finkelman[2], Olle Selinus[3], and Florabel G. Mullick[1]
[1]Department of Environmental and Infectious Disease Sciences, The Armed Forces Institute of Pathology, Washington, DC 20306-6000, USA; [2]University of Texas at Dallas, Richardson, TX, USA; [3]Geological Survey of Sweden, Uppsala, Sweden

Background and Global Implications

Health problems caused by exposure to geogenic arsenic impact many more people than do most high profile health issues. For example, recent estimates indicate that 22 million people worldwide are living with some form of cancer, 35 million have had a stroke, 40 million people are suffering from coronary heart disease, 40 million people suffer from HIV AIDS, and 150 million have diabetes. It is possible that the total number of people who are exposed to toxic levels of arsenic may equal or surpass the combined total (287 million) of all these health problems.

The catastrophic health problems caused by arsenic in the well waters of Bangladesh and West Bengal, India have been front page stories in newspapers, on television, and in scientific journals. Estimates as to how many people are at risk vary, but there is no question that it runs into the tens of millions in Bangladesh alone. This situation has been called the "greatest mass poisoning in history". What is not often reported is that the tens of millions of people exposed to arsenic in Bangladesh represent only a portion of the people who are at risk worldwide. Dangerously high levels of arsenic have been reported in water supplies of communities in Argentina, Austria, Brazil, Canada, China, Ghana, Greece, Hungary, Iceland, India, Japan, Korea, Malaysia, Mexico, Mongolia, Nepal, Romania, Taiwan, Turkey, Vietnam, Zimbabwe, and the U.S.

In addition, arsenic mobilized by coal combustion has caused severe health problems in China and Slovakia. This is not an emerging health problem. Pathologists have identified arsenic-induced lesions in 500-year old mummies in the Camarones Valley, Chile. People living in this region are experiencing the same arsenic exposure as did their ancestors.

Health Impacts from Chronic As Exposure

The future is bleak for many of the people exposed to high levels of arsenic from inhalation, ingestion of tainted food, water, crops, or soil. Inorganic arsenic has been recognized as a human poison since ancient times, and large doses can cause death. Arsenic is a system toxicant known to induce cardiovascular diseases, developmental abnormalities, neurologic and neurobehavioral disorders, diabetes, hearing loss and hematologic, gastrointestinal, renal and respiratory disorders. Perhaps the single most characteristic effect of long-term oral exposure to inorganic arsenic is a pattern of skin changes. These include a darkening of the skin and the appearance of small lesions on the palms, soles, and torso. A small number of the lesions may ultimately develop into skin cancer. Chronic arsenic exposure from oral ingestion (and/or inhalation) has been associated with a variety of cancers involving urinary bladder, lung, liver, and kidney.

The number of people affected by arsenic is staggering, the problems life threatening, the scope global, and the potential for Medical Geology interventions – enormous. In this presentation, we provide an overview of the global health impacts from chronic arsenic exposure. Recent research efforts to understand potential associations between urinary excretion of inorganic arsenic and other metalloids such as selenium will be briefly reviewed as a way to evaluate As metabolite distribution and disease.

HEALTH EFFECTS OF ARSENIC IN DRINKING WATER, Prof. Marie Vahter, Institute of Environmental Medicine, Karolinska Institutet, Stockholm, Sweden

Exposure to arsenic in drinking water (ground water) is a global public health problem. The situation is particularly serious in many low-income countries, where people often are obliged to use ground water for drinking purposes because of water constraints or pollution of available surface water sources. Often, mitigation possibilities are limited. Because of the increasing dependence of ground water for drinking purposes, it is an urgent task to carefully evaluate the health risks by arsenic, as well as other toxic elements in water, and to screen the element composition of the water sources before use. The use of arsenic-containing ground water for irrigation leads to wide-spread contamination of land and additional exposure via food.

The health consequences of chronic arsenic exposure include various forms of cancer, e.g. skin, lungs, urinary bladder and kidney. The estimated cancer risk at the current WHO drinking water guideline, 10 µg/L, is in the range 1/1000 to 1/100. Non-cancer effects associated with arsenic exposure include diabetes, skin diseases, chronic cough, and toxic effects in liver toxicity, kidney, cardiovascular system, peripheral- and central nervous systems. Although effects on reproduction have been indicated in several studies, little is known about effects on fetal and child development. Our ongoing studies in Matlab, Bangladesh aim at elucidating the pregnancy outcomes and health effects in children following early-life exposure to arsenic via drinking water. The concentrations of metabolites of inorganic arsenic in urine during pregnancy, as measure by HPLC-HG-ICPMS, vary between 1 and 1,500 µg/L. There is a significant correlation between arsenic in urine and arsenic in water, but indications of additional exposure via food.

Reported mechanisms or mode of action of arsenic include enzyme inhibition, including DNA repair enzymes and enzymes involved in cell cycling, oxidative stress, epigenetic effects, interactions with nuclear receptors, and un-coupling of cellular respiration. Apparently, the mode of action is highly dose-dependent. Several in vitro arsenic toxicity models have shown that very low doses (submicromolar) of arsenic cause cell proliferation, while higher doses lead to apoptosis and even necrosis. This is also reflected in the promising use of arsenic in cancer treatment, especially acute promyelocytic leukemia, while chronic exposure via drinking water is highly carcinogenic.

There seems to be a vide variation in susceptibility to arsenic toxicity. Known risk modifying factors include gender, age, genetic predisposition, nutrition and metabolism of arsenic. Arsenic is metabolized by a series of reduction and oxidative methylation reactions, obviously modulating the toxicity.

THE NEW IMGA LOGO

RADON IN AIR AND WATER, Dr. James Donald Appleton, British Geological Survey, Keyworth, Nottingham, NG12 5GG, UK

Radon is a natural radioactive gas that you can't see, smell or taste. It is produced by the radioactive decay of radium, which in turn is derived from the radioactive decay of uranium. Radon decays to form radioactive particles that can enter the body by inhalation. Inhalation of the short-lived decay products of radon has been linked to an increase in the risk of developing cancers of the respiratory tract, especially of the lungs. Breathing radon in the indoor air of homes contributes to about 20,000 lung cancer deaths each year in the United States and 2,000-3,000 in the UK. Only smoking causes more lung cancer deaths.

Geology is the most important factor controlling the source and distribution of radon. Relatively high levels of radon emissions are associated with particular types of bedrock and superficial deposits, for example some, but not all, granites, phosphatic rocks, and shales rich in organic materials.

Radon levels in outdoor air, indoor air, soil air, and ground water can be very different. Concentrations in the open air are normally very low and probably do not present a hazard. Radon that enters poorly ventilated buildings, caves, mines, and tunnels can reach high concentrations in some circumstances. The concentration of radon in a building primarily reflects:

1. the detailed geological characteristics of the ground beneath the building, which determines the potential for radon emissions, and;

2. the structural detail of the building and its mode of use, which determines whether the potential for radon accumulation is fulfilled.

The radon potential of the ground may be assessed from a geologically based interpretation of indoor radon measurements in conjunction with permeability, uranium, soil gas radon, and ground and airborne gamma spectrometric data. Radon potential maps have important applications, particularly in the control of radon through environmental health and building control legislation. Whereas a geological radon potential map can indicate the relative radon hazard, it cannot predict the radon risk for an individual building. This can only be established by having the building tested.

Radon in water supplies can result in radiation exposure of people in two ways: by ingestion of the water or by release of the radon into the air during showering or bathing, allowing radon and its decay products to be inhaled. Radon in soil under homes is the biggest source of radon in indoor air, and presents a greater risk of cancer than radon in drinking water.

IMGA WEBSITE

Work has started on the website to reflect the new IMGA. One of the next steps will be to establish a members only part of the website with a password.

SELENIUM DEFICIENCY AND ENDEMIC HEART FAILURE IN CHINA Prof. Changsheng Li, Institute for the Study of Earth, Oceans, and Space, University of New Hampshire, Durham, NH 03824, USA, Phone: 603-862-1771, E-mail: changshneg.li@unh.edu

In middle 1930s, a terrible disease of heart failure was found in some rural areas in Northeastern China. Women and children were its primary victims. The disease frequently occurred without warning and led to the death of a large number of people. In the following decades preliminary researches were conducted on the suspected causes such as bacteria, virus, parasites and other biotic factors but without any positive results. The peculiar disease was then named after the county, Keshan in Heilongjiang Province, China, where the disease was first identified.

In 1968, an interdisciplinary research team was organized by the Chinese Academy of Sciences in collaboration with the State Office of Northern Endemic Diseases Prevention to resume the study on Keshan disease but with a new focus on its geochemical environment. The team started their field investigation in Heilongjiang Province, one of the regions with Keshan disease most prevalent in China. In the province, Wuyur River watershed across hundreds of villages affected or unaffected by Keshan disease was selected as a target area. Within the domain of about 3000 km^2, a large number of villagers dead every year in the upper stream of the watershed, but the disease had never been observed in the downstream of the watershed. Analytical results from the soil and water samples collected across the watershed indicated a significant difference in their contents of dissolved anions and cations between the affected and unaffected villages. Through comparison on the conditions of climate, topography, land cover, and soil between the affected and affected areas in the watershed, the deficiency of mineral elements in the soil-water systems of the upper stream areas was attributed to leaching effect. A simple model was developed to define a leaching index (LI) by integrating the impacts of climate, topography, soil and vegetation on the dynamics of soluble ions in the soils. By applying the model to the entire Heilongjiang Province, the researchers identified a number of grid cells where the LI values were higher than a selected threshold level. All the affected villages were located within the identified grid cells. There were also several horse farms located within the affected areas where the animals were suffering from White Muscle disease, a livestock trouble with a known cause of deficiency of selenium (Se).

Fueled by the initial findings, field campaigns were carried out nationwide to screen the chemical elements that were hypothetically related to Keshan disease. Numerous samples of soil, water, diet, crops, and human urine, hair and blood were collected from contiguous affected and affected areas in all of provinces where Keshan disease was reported. Selenium deficiency was consistently confirmed to be one of the major geochemical characteristics for the areas affected by Keshan disease. Medical researchers and doctors were actively involved in the study and advanced the Se supplementation in the affected areas in 1970s and 1980s that finally ended the miserable era of the endemic myocardial disease.

SELENIUM GEOCHEMISTRY AND HEALTH,

Dr. Fiona Fordyce, British Geological Survey, West Mains Road, Edinburgh, EH9 3LA, UK. fmf@bgs.ac.uk

Selenium is a naturally occurring metalloid element, which is essential to human and other animal health in trace amounts but is harmful in excess. Of all the elements, selenium has one of the narrowest ranges between dietary deficiency ($< 40\ \mu g\ day^{-1}$) and toxic levels ($> 400\ \mu g\ day^{-1}$) making it necessary to carefully control intakes by humans and other animals hence the importance of understanding the relationships between environmental exposure and health. In animals and humans, selenium forms a vital constituent of the biologically important enzyme glutathione peroxidase (GSH-Px) and to date approximately 20 essential selenoprotiens have been identified. Selenium deficiency has been implicated in white muscle disease in animals and in a host of conditions in humans including cancer, heart disease, osteoarthropathy, immune system function, reproduction and thyroid function. In contrast, selenium toxicity or selenosis can cause 'alkali disease' in animals and vomiting, diarrhoea, hair and nail loss and nervous disorders in humans. Examples will be presented showing that geology exerts a fundamental control on the concentrations of selenium in the soils on which we grow the crops and animals that form the human food chain and the selenium status of populations, animals and crops vary markedly around the world as a result of different geological conditions. Understanding the biogeochemical controls on the distribution and mobility of environmental selenium is key to the assessment of selenium-related health risks. Although overt clinical symptoms of selenium toxicity and deficiency are rarely reported, the possible sub-clinical effects and implications of selenium status are at present poorly understood and should not be underestimated as medical science continues to uncover new essential functions for this biologically important element.

POSTGRADUATE TRAINING IN MEDICAL GEOLOGY,

Prof. Philip Weinstein
Head of School of Population Health, University of Western Australia, 35 Stirling Highway, Crawley, WA 6009, Phone +61 8 6488 8108, Fax +61 8 6488 1188, philip.weinstein@uwa.edu.au

The School of Population Health at the University of Western Australia (Perth) runs an active postgraduate training and research programme in Medical Geology. Examples of current postgraduate student projects:

- ***The association between soil salinisation and health outcomes***. Using both existing data and ground-truthed field data, an association between soil salinisation and cardiovascular and psychiatric disease has been established (PhD student Peter Speldewinde), and between soil salinisation and the risk of mosquito borne disease (PhD student Andrew Jardine).
- ***Dust as a regional driver of asthma*** (PhD student Mark Laidlaw): Using GIS tools, this work is mapping dust in towns adjacent to natural (desert) and anthropogenic (mining) sources of dust. The maps are overlaid with asthma rates to look for possible associations, and attributable disease burdens calculated.
- ***Groundwater quality and adverse health outcomes***. This study is based largely on the different disinfection by-products that result from high organic loads in both groundwater (permeable sand and limestone with lots of agriculture) and surface water. (PhD students Kim Chisholm and Sarah Joyce).

Our group has excellent breadth and depth in environmental epidemiology, multidisciplinary collaborations second to none, and an enthusiastic group of 15 postgraduate students who all enjoy Perth's sun, beaches, and unique geological attributes! If you are considering postgraduate research training in Medical Geology, please contact us to discuss the broad range of possibilities!

HEALTH EFFECTS OF TOXIC ORGANIC SUBSTANCES FROM COAL: PANDEMIC NEPHROPATHY, Dr. William Orem, U.S. Geological Survey, 956 National Center, Reston, VA USA; 703-648-6273 office; 703-648-6419 fax; borem@usgs.gov
William Orem[1], Calin Tatu[2], Nikola Pavlovic[3], Joseph Bunnell[1], Harry Lerch[1], Virgil Paunescu[2], Valentin Ordodi[2], Margo Corum[1], and Anne Bates[1] [1]U.S. Geological Survey, Reston, VA, USA, [2]University of Medicine and Pharmacy "Victor Babes", Timisoara, Romania, [3]Nephrologist, Nis, Serbia

Coal contains myriad organic compounds, some known to be toxic (e.g. polycyclic aromatic hydrocarbons, aromatic amines) and others that are potentially toxic (e.g. N, S-, and O-containing heterocyclic compounds). Mobilization of toxic organic compounds from coal into the environment through combustion or through leaching into water, and long-term human exposures to these compounds may lead to disease occurrence. One example of a disease linked to coal-derived toxic organic compounds in water supplies is Balkan Endemic Nephropathy (BEN).

BEN is a kidney disease with a high co-incidence of renal/pelvic cancer (RPC), and occurs only in clusters of rural villages in Romania, Serbia, Bulgaria, Croatia, and Bosnia. The unusual geographic restriction of BEN is spatially correlated with the occurrence of Pliocene coal (lignite) deposits. The hypothesis being tested is that groundwater leaches toxic organic compounds from lignite located in hills surrounding endemic villages, and transports these compounds to wells/springs used as water supplies. Exposure to these toxic, coal-derived organic compounds for 20+ years may be a factor (combined with genetics and other factors) leading to BEN and RPC. Results of our field and laboratory studies have demonstrated that: (1) drinking water from BEN villages has higher concentrations and numbers of low and high molecular weight organic compounds than drinking water from control sites (nonendemic villages); and (2) organic compounds in drinking water from BEN villages are similar to compounds in laboratory water leachates of coal (lignites) from BEN areas. Toxicological studies on human kidney and other types of cells have shown that organic compounds extracted from BEN area lignites, and organic compounds isolated from the well water in BEN villages can stimulate cell proliferation in culture, suggesting possible carcinogenic properties linked to RPC. In higher concentrations, the same extracts can inhibit proliferation and possibly induce cell death, effects that could explain their nephrotoxic effects.

High rates of RPC are also found in the USA in States having low rank coal deposits and rural populations using groundwater for water supplies. Preliminary results show that wells in aquifers containing coal in WY and LA contain significantly higher concentrations of organic compounds compared to control sites. Some of the types of organic compounds observed in well water from WY and LA closely resemble those observed from wells in BEN villages. These results and other observations have led to the development of the concept of Pandemic Nephropathy, or BEN-like diseases worldwide that appear to be linked to coal-derived toxic organic compounds in drinking water.

HEALTH IMPACTS OF COAL: FACTS AND FALLACIES, Dr. Robert B. Finkelman, University of Texas at Dallas, Richardson, TX, USA

Coal has contributed enormously to the advance of civilization by providing an abundant, inexpensive, and convenient source of energy. Concurrent with its contributions coal has extracted a high cost in terms of environmental damage and human health impacts. Coal will remain a key component of the global energy mix as well as a major source of global pollutants. Despite its high media profile misconceptions about coal abound, especially with regard to its human health impacts. Coal also provides several excellent examples of how a geologic material and human health intersect in a variety of surprising ways.

The potential for health impacts caused by exposure to trace elements has received considerable attention for the past quarter of a century. However, documented examples of these health impacts are rare. Perhaps the most significant example occurs in Guizhou Province, southwest China, where millions of people suffer from dental and skeletal fluorosis and thousands suffer from arsenic poisoning due to mobilization of these elements by burning mineralized coals in unvented or poorly vented stoves. A highly surprising relationship between coal and human health has been detected in this region of China. Communities in which coal is the principal source of residential fuel have a low incidence of Iodine Deficiency Disorders (IDD) whereas communities that primarily rely on wood have a far greater incidence of IDD. Chemical analyses of the fuels indicate that the coal is markedly enriched in iodine. Burning the coal in the home to dry crops mobilizes the iodine and may provide a significant health benefit in preventing IDD.

An unusual situation exists in the Balkans where there may be health problems caused by coal in the ground. Well waters containing polycyclic aromatic hydrocarbons and other organic compounds leached from low-rank coals may be the cause of, or a contributing factor to, Balkan Endemic Nephropathy (BEN), an interstitial nephropathy, that is believed to have killed more than 100,000 people in Yugoslavia alone. Work on BEN has led to evidence that similar health problems may exist in Portugal and in the U.S.

Not all of the allegations of health problems caused by coal are legitimate. Concerns expressed about exposure to radioactivity from coal and coal combustion products are misplaced. The products of commercial coal combustion (fly ash, bottom ash) do have uranium and thorium concentrations about 5-10 times higher than that of the coal. But the uranium and thorium in the coal byproducts should not cause concern as they are mostly in insoluble forms at concentration levels similar to most soils.

The health impacts of uncontrolled coal fires is a poorly understood phenomenon. These fires, initiated by coalmine accidents, lightning strikes, or by spontaneous combustion, are a worldwide phenomenon and are especially prevalent in China, India, and South Africa. Emissions from these fires include high concentrations of benzene, toluene, xylene, ethylbenzene, arsenic, selenium, fluorine, mercury, and other potentially toxic heavy metals.

For more than 100 years it has been assumed that black lung disease (Coal Worker's Pneumoconiosis: CWP) was caused by the inhalation of the black pulverized particles of coal. Recent research, however, has shown that CWP may be initiated not by the coal particles but by inhalation of pulverized pyrite, a common coal mineral. The pyrite dissolves in the lung fluids releasing strong acids that irritate the lung tissues. Particles that then contact the irritated tissues will cause the fibrosis leading to decreased oxygen exchange capacity.

METAL BIOLOGY - ASPECTS OF BENEFICIAL EFFECTS

Prof. Ulf Lindh Research in Metal Biology, Rudbeck Laboratory, Uppsala University, SE-751 85 Uppsala, Sweden.

Metal biology is in many senses a broader concept than trace element biology. However, to be of practical use the idea of metals has to be expanded to include also trace elements that are not metals. Beneficial aspects of trace elements are always associated with essentiality. The definition of essentiality will be discussed.

The very familiar metal iron has two sides; one beneficial such as the integral part of the prosthetic group haem responsible not only for oxygen transport but for the function of a series of haem-dependent enzymes. The converse is the property of iron of taking part in reactions that generate radicals. In this aspect, iron has been suggested to be responsible for the development of atherosclerosis as well as the destruction of dopaminergic cells in substantia nigra leading to Parkinson' disease.

Zinc is perhaps the best example to illustrate the biological role of metals. It is not only essential part of some three hundred enzymes but it is necessary for the proper function of the immune system, gene expression, storage of insulin to mention only a few functions.

Selenium is relatively new in the branch of essential trace elements. For quite some time it was associated only with the function of glutathione peroxidase, a scavenger of reactive oxygen species. We now know some twenty selenium-dependent enzymes in mammals and an additional twenty in prokaryotes.

A triad of metals, chromium, molybdenum and tungsten has some very exciting biological properties in some cases predominantly associated with the domain Archaea. In addition to those metals, the biological properties and speculative functions of vanadium will be presented.

MEDICAL GEOLOGY NEWSLETTER ARTICLE SUBMISSIONS TO:

Dr. David C. Elliott, Newsletter Editor
3507 Boulton Rd. NW, Calgary, Alberta T2L 1M5, Canada.
(403) 220 1853 Home or (403) 297 4008 Work
davide5@telus.net

- Submissions should be in English preferably in MS Word 2000. Preferred graphics formats are jpg, .bmp, .gif, .wmf (Windows Metafile). Graphics will be produced in colour if possible but should also be legible in black and white and also when reduced to fit in the newsletter.
- Articles may be edited to fit into the space available in the Newsletter or for clarity.
- Submission of an item implies the assignment of a non-exclusive copyright to the IMGA.
- Articles should not have been published previously. Summaries of previously published articles may be acceptable, but the editor should be advised, and a reference must be provided to the original publication. It is the author's responsibility to ensure that there are no copyright violations.

CONTACT THE EDITOR FOR MORE INFORMATION

MOBILISATION AND ENVIRONMENTAL CYCLING OF MERCURY

Dr. John Munthe, IVL Swedish Environmental Research Institute, PO Box 5302, 400 14 Gothenburg, Sweden, Email: john.munthe@ivl.se

Mercury is an element with a complex biogeochemical cycle in air, soils, water and biota, and with both natural and anthropogenic sources. The main concern of mercury in the environment is associated with elevated concentrations of methylmercury in fish. In Boreal regions, mercury in the environment is to a large extent accumulated in soils and sediments with only small fractions available for uptake in aquatic food chains. This presentation will focus on external factors which can affect the environmental biogeochemistry of mercury and increase the risks of bioaccumulation in aquatic ecosystems. Three examples where an increased mobilisation of mercury and methylmercury from forest soils to aquatic ecosystems has been observed will be given: Forestry, storm-felling and climate change. Modern **forestry** with heavy machinery causes damages to forest soils in the form of wheel tracks and destroyed soil structure. Large increases of leaching (a factor of 2-4) of methylmercury via run off water have been observed in affected forested catchments in Sweden and Finland. The effect is long-term and is most likely caused by the formation of anaerobic zones in the soil where conditions for methylation of mercury are favourable. These observations led to concerns of the impacts of the **storm** "Gudrun" which occurred in the winter of 2005 causing extensive damage to the forests in many regions in south Sweden. Very extensive clearing-up operations were initiated after the storm when large areas of storm-felled forests had to be cleared. A preliminary assessment of the potential for increased methylmercury loadings on the surface waters in this region was prepared during the first year after the event and some sampling of run-off water was initiated in the affected areas. Available information suggests that significant increases of methylmercury loadings on some lakes may occur and that further monitoring of methylmercury levels in water and in fish is warranted. Finally, recent experimental work conducted at the Gårdsjön research site in SW Sweden suggests that **climate change**, in the form on increased precipitation amounts, can dramatically increase the leaching of methylmercury from forests soils to surface waters.

GEOHEALTH AND MEDICAL GEOLOGY LISTSERVE

A listserve for the geology and health, and medical geology community worldwide has been created. To join the list please send an email to diamspir@aol.com with "subscribe to geohealth" in the subject line. This list is hosted by Ulli Limpitlaw at the University of Northern Colorado, Greeley, CO. After signing up you will be sent a confirmation and instructions. Those who have asked to join, have been subscribed and should have a confirmation in their in-box.

Ulli Limpitlaw
Department of Earth Sciences
Box 100
University of Northern Colorado
Greeley, CO 80639

MEDICAL GEOLOGY – AN OPPORTUNITY FOR THE FUTURE

Dr. Olle Selinus, Geological Survey of Sweden, PO Box 670, 75128 Uppsala, Sweden, olle.selinus@sgu.se

Because of the importance of geological factors on health an International Working Group on Medical Geology was established in 1998, with the primary aim of increasing awareness of this issue among scientists, medical specialists, and the general public. In 2000 a new project was established by UNESCO. The primary aim of the projects were to bring together, at the global scale, scientists working in this field in developing countries with their colleagues in other parts of the world. The International Council of Scientific Unions (ICSU) also sponsored international short courses in this subject, a cooperation involving The Geological Survey of Sweden, US Geological Survey and the US Armed Forces of Pathology. In 2006 a new association was established: International Medical Geology Association, IMGA.

Regional Divisions all over the world have been established. Two text books have been published, the most recent one by Elsevier 2005: Essentials of Medical Geology which has received two prestigious international awards. A website, http://www.medicalgeology.org, and regular newsletters have been published. Short courses on medical geology, have been held since 2001 in e.g. Zambia, Chile, Brazil, Russia, Canada, Puerto Rico, UK, Lithuania, China, Australia, Malaysia, Venezuela, Mexico, USA, Peru, China, Japan, India, Ukraine, South Africa, Mozambique, Puerto Rico, Romania, Brazil, Argentina, Uruguay and several other countries.

Medical geology will also be one of the ten topics within the Year of Planet Earth declared by UN General Assembly December 22, 2005. The year will be a triennium between 2007 and 2009. Medical geology is also one of the five topics within the GeoUnion initiative. The international impact has been tremendous. Universities all around the world are starting courses and education in medical geology, the first centers are under construction, symposias have been held and a world wide collaboration has started between geoscientists, environmental researchers, epidemiologists, toxicologists, pathologists and other scientists.

IMGA DUES REMINDER: Category 1 Country Members

Category 1 country members dues are due. Please send to the bank account or, if you wish to pay by credit card you can use the IBAN and BIC code at the bank office.

Bank: Plusgiro (NORDEA), Sweden
Account no: 166 95 46-2
Bankaccount no: 9960 341669 5462
IBAN: SE30 9500 0099 6034 1669 5462
BIC-kod (SWIFT-adress): NDEASESS

Further information on dues, including on-line payment using PayPal, can be found at http://www.medicalgeology.org/dues.htm. Editors note: I was pleasantly surprised how easy it was to use PayPal.

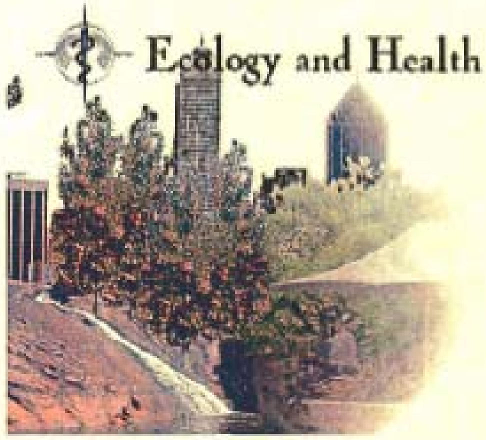
Plans are in hand to enable US members to pay to a US bank account.

Members of categories 2-4 shall wait with payment until the regional divisions are established.

Short Course in Ecology and Health

With a special component on the geogenic drivers of disease emergence

(Self-standing course or available for degree programme credit as a full unit)



Monday 20 to Friday 24 November 2006.

Location: The University of Western Australia, Perth

www.uwa.edu.au

www.dph.uwa.edu.au/welcome/research/ehr/ehrhome/about

A great excuse to spend some time in Australia!

Content: This postgraduate-level course provides a regional and global perspective on health impacts from environmental disturbance. The following topics are covered: historical, current and emerging perspectives of ecological change and disease; health perspectives of indigenous cultures and the environment; health consequences of human population growth, urbanisation and industry; organism modification (GMOs); global processes and health including the effects of climate change, biodiversity loss, and the geogenic drivers of disease emergence; environmental change and infectious disease ecology; the future for the world's ecosystems and human communities.

Lectures are supported by the intensive use of case studies and discussions of recent national and international issues.

Outcomes: Students are able to describe, interpret and apply a conceptual framework with which to accurately understand and describe the inter-relationship between ecological change and disturbance and human health; monitor and analyse available information sources which relate the human disease burden to environmental factors (e.g. pollutants) including the use of data from environmental monitoring and epidemiological studies; employ problem-solving skills to address ecology and health issues relevant to their own experiences and occupational contexts; appraise issues, identify and locate sources of information, and conduct critiques to solve ecology and health-based problems; and predict and intervene in new environmental issues as they emerge within a regional and global context (e.g. water scarcity, changing biogeochemical cycles, and climate change).

Unit Co-ordinators:

Professor Philip Weinstein
MBBS PhD MAppEpi FAFPHM
Regional Coordinator,
International Medical Geology Association.
Head, School of Population Health, UWA.

Dr Angus Cook MBChB PhD
Natural Disaster Chair,
International Medical Geology Association.
Director, Ecology and Health,
School of Population Health, UWA.