Strengthening Environmental Health in Malaysia – Linking Medical Geology to Health and the Environment

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Introduction

Medical Geology is a rapidly growing discipline that compliments environmental health in dealing with the impacts of geological materials and processes on humans, animals and plants (Finkelman *et al*., this volume). The discipline links geologists directly to medical, dental and veterinary specialists and indirectly to botanists and zoologists. Research on medical geology is integrative in nature, embracing disciplines as diverse as mineralogy and geochemistry to epidemiology and pathology. The focus is on relationships between human and animal health and rocks, soil and water. Medical Geology has the potential to help address a range of health problems including emerging diseases.

The paper commences with an overview of international developments in the field of medical geology. This is followed by a brief description of the first workshop held in Malaysia to introduce medical geology. Salient points from the discussion on research and capacity building needs in Malaysia has also been documented. These include the types of research required, challenges related to data and potential collaborations and linkages to facilitate access to instruments and capacity building for research.

International Developments in Medical Geology

The importance of geological factors on health, and the general lack of understanding the importance of geology in such relationships, led the Commission on Geological Sciences for Environmental Planning (COGEOENVIRONMENT) of the International Union of Geological Sciences (IUGS) to establish the International Working Group on Medical Geology in 1996 (Selinus 2004). The Working Group was directed from the Geological Survey of Sweden (SGU), with the primary aim of increasing awareness of this issue among scientists, medical specialists, and the general public. In 2000 the United Nations Educational, Scientific and Cultural Organization (UNESCO) recognised the need for increased awareness and supported IGCP Project #454 on Medical Geology. The primary aim of the Project was to bring together, at the global scale, scientists working in this field in developing countries with their colleagues in other parts of the world stressing the importance of geoscientific factors that affect the health of

humans and animals. In 2003-2004, the International Council of Scientific Unions (ICSU) also sponsored international short courses in this subject, in collaboration with SGU, United States Geological Survey (USGS) and the US Armed Forces of Pathology (AFIP).

Through these initiatives, for the first time, leading scientists from developing countries came together in a truly international and inter-disciplinary way (involving geoscientists, physicians and veterinarians) to identify and tackle real problems of geoenvironment and health. Capacity building workshops and training courses have been held in over 60 countries world-wide (see http://www.medicalgeology.org/ for further information). A book has been published by Oxford Press based on the proceedings of a Medical Geology Conference organised in Uppsala, Sweden in September 2000. In addition, national groups have been established to strengthen information dissemination and create synergies for research and policy advocacy in addressing issues related to medical geology.

These significant achievements resulted in the International Working Group on Medical Geology being given Special Initiative status by the IUGS, operating directly under the Executive. However, interest in Medical Geology is continuing to expand worldwide at an increasingly rapid rate and a formal structure is necessary to respond effectively to new opportunities, disseminate information efficiently to interested parties, and make critical decisions that will benefit the discipline. Thus, with support from the IUGS, a new association was developed in 2004, the International Medical Geology Association (IMGA). As part of its activities, the IMGA will play an important role in the establishment of the first Centre for Medical Geology in China. The second center is under discussion in South Africa.

Medical Geology in Malaysia

Medical Geology was first introduced in Malaysia at the Workshop on Medical Geology: Metals, Health and the Environment, held at the Institute for Medical Research Malaysia (IMR) in Kuala Lumpur on 8th and 9th December 2003. The Workshop was convened by the Institute for Environment and Development (LESTARI) of Universiti Kebangsaan Malaysia, the Environmental Health Research Centre (EHRC), the Minerals and Geoscience Department Malaysia (JMG), and COGEOENVIRONMENT. It was jointly sponsored by the U.S. Armed Forces Institute of Pathology (AFIP), US Geological Survey (USGS), Geological Survey of Sweden (SGU), International Union of Geological Sciences (IUGS), International Medical Geology Association (IMGA), United Nations Educational, Scientific and Cultural Organization (UNESCO), International Geological Correlation Programme IGCP#454 and International Council of Scientific Unions (ICSU). About 40 professionals comprising practitioners and researchers from various government departments attended the Workshop. Among these were hydrogeologists, geochemists, chemists, soil scientists, biologists, environmental scientists, toxicologists, parasitologists, epidemiologist, public health engineers and other medical researchers.

The Workshop was led by Directors of the newly established International Medical Geology Association, Dr. Olle Selinus of the SGU, Dr. Robert B. Finkelman of the USGS and Dr. Jose A. Centeno of the AFIP. The most recent information on the relationships between toxic metal ions, trace elements, and their impacts on environmental and public health issues were discussed. The

scientific topics included environmental toxicology, environmental pathology, geochemistry, geoenvironmental epidemiology, extent, patterns and consequences of exposures to toxic metal ions in the general environment, biological risk assessment, modern trends in metal analysis and updates on the geology, toxicology and pathology of metal ion and dust exposures.

On completion of the Workshop, the participants obtained information on the types of evidence available about geological sources and processes and manifestations of exposures to toxic metal species. They also obtained an elementary understanding of environmental toxicology, epidemiology and medical geology as applied to the study of toxic metal species and trace elements.

Research and Capacity Building Needs for Malaysia

The Workshop concluded with a Panel Discussion on the issues, needs and opportunities for medical geology and human health in Malaysia. The objective was to identify research needs as well as potential collaborations and linkages for this purpose. The Panelists were Dr. Stephen Ambu from IMR, Dr. Saim Suratman from JMG and Prof. Hamzah Mohamad from UKM. Each Panelist presented his viewpoint and this was followed by a lively enthusiastic discussion.

Issues related to the extractive and food processing industries were highlighted (Hamzah 2003). In the case of the extractive industries, there is a need to investigate the geochemistry and toxicology of dust from rock quarries. In addition, the impact of gold mining, which is associated with high levels of arsenic and mercury, on the surrounding streams, soils and river life forms should also be investigated. In both cases, a clinical study of the surrounding population should be conducted. Building materials in the Klang Valley are derived from granitic rocks and sand, which contain minerals such as xenotime and monazite that are radioactive in nature. An investigation of the baseline and exposure levels of radioactivity in the population may also be in order. With respect to the food processing industry, the health impacts of using artificially fortified water and natural minerals in traditional food processing needs to be investigated. Preliminary results indicate high levels of heavy metals in products using such materials.

The JMG collects and conducts chemical analyses of groundwater as part of their mandate. The groundwater data reveals high levels of arsenic, iron, calcium, copper and nitrate in some parts of the country. It was recommended that research be conducted to investigate the impact of such levels on the population, particularly where groundwater is the principal source of drinking water. The meeting was also informed of the drinking water database available at the Engineering Services Division, Ministry of Health (MOH).

Another aspect of interest was the geochemical database available at the JMG. Over the past decade, the JMG has accumulated much geochemical data as part of their mineral exploration activities. Such information, in particular the soil geochemistry, is very useful to determine areas with anomalous levels of heavy metals. Soil geochemical maps are very useful to identify problematic zones, so that research can be conducted to assess their implications, with respect to uptake through crops and cattle. The need to study the spatial distribution of diseases among the population in the effort to identify and isolate its principle cause was also highlighted. The

dengue disease surveillance system developed by the Public Health Faculty of UKM Hospital, in conjunction with several collaborators, was cited as an example.

One of the major challenges in Malaysia is difficulty in obtaining data in an appropriate format. Data is collected on a routine basis at national, state and local levels, sometimes as part of enforcement activities. This is particularly true for data on water quality and health related matters. Unfortunately, the collection of such data is not coordinated and there is no common approach to data management. The problem of poor documentation is compounded by routine transfer of officers in charge of such data. In addition, data collected by some institutions have to be bought, and this sometimes impedes research activities, particularly in universities.

The discussion also focused on the availability of instruments and capacity building for research in medical geology. Participants were informed that the AFIP welcomes international collaborations and this could be one way to address problems related to non-availability of instruments. Access to training, instruments, internships and grants for research would also be available with the imminent establishment of a Centre for Medical Geology in China, with support from the US Government. The goal of the proposed Centre is to find practical solutions to a wide range of environmental health problems. In addition to training and technical support, the anticipated benefits of such a Centre would include developing experience with environmental health issues and establishing early warning systems for emerging diseases.

The discussion ended with a call to establish a National Committee for medical geology in Malaysia. It was proposed that the proposed Committee oversee research needs and collaboration to strengthen capacity in this discipline in the country. The three local institutions that organised the Workshop were requested to take the lead in this matter. The three institutions have since met and are planning follow-up activities.

Conclusions

Research opportunities for medical geology are abundant in Malaysia given its importance to public health and well being. Such opportunities encompass issues related to the extractive and food processing industries, elevated levels of heavy metals in groundwater and soil, and its implications on the population, crop and cattle. Notwithstanding this, there are many challenges to be addressed, particularly with respect to data availability, resources and capacity. In this context, potential collaborations and linkages can be established to facilitate access and mobilise resources.

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