Medical Geology and Public Health

Hannah Smith, Dept. of Biology, Western Oregon University, Email: hsmith12@wou.edu

Abstract

Medical Geology is a developing field that requires collaboration of many scientific disciplines, including geologists, chemists, biologists, and medical anthropologists. This paper explores the relationship between the geologic environment and public health. Several case studies are discussed to identify influencing factors that affect human health, including air, water, and soil quality. One of these studies includes the recently publicized Portland Moss and Air Quality Report. This emerging technique is being used by scientists to measure air pollutants in urban areas. Mosses act as sponges in the environment, absorbing airborne contaminants and pollutants. By collecting, examining, and testing the types of contaminants within samples of moss, we are able to better understand urban air quality and minimize potential public health risks. Recognizing the important linkage between humans and the geologic environment allows policy makers to improve mitigation of public health hazards and encourages society to maintain healthy ecosystems.

Introduction

Medical Geology is the science dealing with the relationship between natural and anthropogenic geological factors and health.

- Earthquakes
- Volcanic Eruptions
- Pollution: soil and water contamination
- Landslides
- Radiation
- Dust Storms
- Floods
- Mining

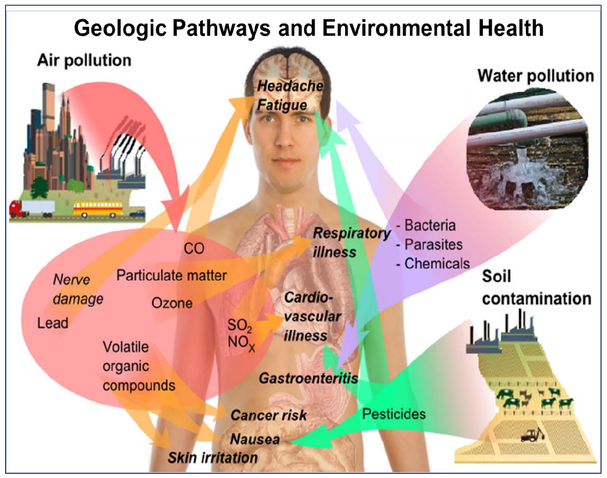
Health Effect [a]	*Sensitive Group*	*Examples of Associated Chemicals*	
Cancer	All	Asbestiform minerals Polycyclic aromatic hydrocarbons (PAHs) Benzene Some metals Some pesticides Some solvents Natural toxins	
Cardiovascular diseases	Especially elderly	Carbon monoxide Arsenic Lead Cadmium	Cobalt Calcium Magnesium
Respiratory diseases	Children, especially asthmatics	Inhalable particles Sulphur dioxide Nitrogen dioxide Ozone	Hydrocarbons Some solvents Terpenes
Allergies and hypersensitivities	All, especially children	Particles Ozone	Nickel Chromium
Reproduction	Adults of reproductive age	Polychlorinated biphenyls (PCBs) DDT Phthalates Other endocrine disrupters	
Developmental	Fetuses, children	Lead Mercury Other endocrine disrupters	
Nervous system disorders	Fetuses, children	PCBs Methyl mercury Lead Organophosphates, including pesticides	Aluminium Organic solvents Manganese

(a) The link between chemicals and health effect varies from well-known causal relationships, such as that between benzene and leukemia, to suggestive associations such as that between pesticides and chemical sensitivity.

Significance

Developing methods of identifying environmental hazards that pose a risk to health will lead us to new targets for prevention and intervention of environmental induced lung diseases, cancers, degenerative diseases, heavy metal poisoning, and other serious illnesses. It will also provide us with the information needed to…

1. Inform the public of environmental health risks associated with geologic materials or processes based on geographic location.
2. Record, map, and track rates and occurrences of environmental induced illnesses.
3. Forge global links between countries to find solutions for environmental health problems.



Aside from concerning health risks, there are also potential health benefits from geologic processes. The earliest forms of medicine were derived from rocks and minerals. For thousands of years various clays were used as an antidote for poisons. Medicinal clays are still in use today and may have been the first patented medicine. Many trace elements, rocks, metals, and minerals are used in a wide variety of pharmaceuticals and health care products. Many cultures also believe in the curative and preventative properties of crystals (talismans and amulets).

Conclusion

Medical geology is a field that holds promise in developing new geologic hazard mitigation techniques. Education and networking between social and scientific disciplines will ensure progress towards improving the health and well being of communities on a global scale.

Portland Moss and Air Quality Case Study

Scientists with the PNW Research Station launched an exploratory study in 2013 to measure air pollution in Portland, Oregon, using samples of moss growing on urban trees. Their objective was to see if moss could be useful as a “bioindicator” to identify sources of polycyclic aromatic hydrocarbons and heavy metals, and also develop distribution maps of these substances.

The scientists collected moss samples around Portland using methods that took into account the complex urban setting. After analysis and tests of the samples, they found high levels of cadmium in some of the moss samples that were much higher compared to the other samples. In fact, the distribution of the cadmium data revealed two major hotspots centered around the two largest stained-glass manufacturers in Portland. Cadmium, which is used primarily in nickel-cadmium battery manufacturing, electroplating, and stained glass production, is linked to health problems such as kidney disease and cancer.

This method identified previously unknown sources of heavy metals in Portland. The resulting maps gave state regulators new information they could use to relocate air quality monitors within the city. The scientists found that moss sampling could provide a low-cost source of information to complement existing air quality monitoring.

References

1. Bunnell, J. E., R. B. Finkelman, J. A. Centeno, and O. Selinus. "Medical Geology: A Globally Emerging Discipline." *J Med Syst Journal of Medical Systems* 5.3 (1990): 273-81. 2007. Web. 16 May 2016.
2. Karceski, S. "Early Parkinson Disease and Depression." *Neurology* 69.4 (n.d.): n. pag. *National Institute of Environmental Health Sciences*. Feb. 2014. Web. 16 May 2016.
3. "Medical Geology." *International Medical Geology Association*. N.p., n.d. Web. 16 May 2016. <http://www.medicalgeology.org/pages/public/medicalgeology/page_MedGeo.htm>.
4. "The Portland Moss and Air Quality Study." *Pacific Northwest Research Station*. U.S. Forest Service, n.d. Web. 16 May 2016. <http://www.fs.fed.us/pnw/research/2016/mar/index.shtml>.