Environmental geochemistry – challenges and perspectives

Visiting professor: Zdzisław M. Migaszewski (Jan Kochanowski University in Kielce)

Course description:

Geochemistry plays a significant role in all disciplines of geosciences including environmental sciences, describing interactions between terrestrial, atmospheric, aquatic, natural and anthropogenic systems. The anthropogenic stress is a factor whose impact on natural environment has greatly increased recently. Man-induced transformations of the environment have given a rise to the concept of the Anthropocene and a search for the “golden spike”.

The most dangerous is the chemical aspect leading to degradation and destruction of land, water, air, and biota. The lectures will focus on an overwiew of the crucial issues of environmental geochemistry exemplified by different case studies conducted by the lecturer in Poland and the USA. Because of the pivotal position of geoanalysis, geochemical, mineralogical, petrographic and isotopic methods used for solving different environmental problems will briefly be presented. The environmental geochemistry studies should also include geomorphology of the land, climatic and hydrologic variables, as well as bedrock, soil, flora and fauna characteristics. By studying geochemical processes, we can better understand environmental interactions, and prevent, reduce or eliminate their harmful effects on the environment.

Environmental geochemistry interweaves with a “sister” discipline biogeochemistry which represents perhaps a more holistic approach to dealing with interactions between living organisms and environmental abiotic systems. The key problems of this discipline will also be discussed including some interpretation traps.

It is noteworthy that human activity can trigger a chain of physical, chemical and biological “feedback” processes leading to the accumulation of toxic substances and metabolic products in various biotic and abiotic systems. The scope of this course will also encompass an impact of toxicants on various plant and animal species, man, and diverse ecosystems. This problem includes acid mine drainage, mine tailings especially at historic mining sites, effluents, mineral processing wastes, atmospheric emissions, and agricultural minerals.

The importance of an environmental field of study is tested by its ability to be employed to solve "down-to-earth" problems and concerns. Environmental geochemistry is a unique multidisciplinary domain that has found many useful applications including mineral exploration, environmental geo- and biomonitoring, geochemical and biogeochemical mapping, post-mining and derelict land reclamation, correlation of toxic element anomalies with “hot-spots” of a specific endemic disease, element cycling in an urban environment, and environmental forensic geochemistry case studies. These issues will be briefly discussed in lectures on the perspectives of environmental geochemistry.

Syllabus of the lecture subjects (enlisted):

1. Environmental geochemistry – definitions, relationships with other disciplines, principal objectives, peculiarities.
2. Basic issues of environmental geochemistry – geochemical factors, geochemical classifications of elements, geochemical background vs. baseline, geochemical gradients and barriers.
3. Fieldwork – a crucial stage enabling better understanding of our fragile environment.
4. Significance of sampling in environmental chemical analysis (geoanalysis) – sample characteristics, sampling strategy, methods, techniques, uncertainty.
5. Glance of a geochemist at instrumental chemical element analysis – advantages and disadvantages of basic analytical techniques used.
6. Petrographic and mineralogical microanalysis – optical and electron microscopes, laser-, electron- and ion microprobes.
7. Application of isotopes in environmental geochemistry studies – an introduction to isotope geochemistry.
8. Geochemical, mineralogical and isotope methods utilized in environmental studies.
9. Biogeochemistry – a more holistic approach to the environment; role of biosphere in element cycling, light and shade of interpretation.
10. The use of plants in geochemical exploration and bioremediation.
11. Anthropocene concept – how we have changed the environment and what is the future?
12. Geo- and bioindication of environmental quality.
13. The role of medical geochemistry in environmental sciences – objectives, geochemical environments and extent of diseases.
14. Urban geochemistry – insight into specific anthropogenically-induced environments.
15. Geochemical and biogeochemical mapping – application in land use management and medical geochemistry.
16. Environmental forensic geochemistry – geochemistry as a useful forensic tool.

Termin	Dzień tygodnia	Godzina	Miejsce
11.04.2016	Poniedziałek	16.15 – 19.00	Minicentrum Konferencyjne (Luwr)
12.04.2016	Wtorek	16.15 – 19.00	Minicentrum Konferencyjne (Luwr)
13.04.2016	Środa	16.15 – 19.00	Minicentrum Konferencyjne (Luwr)
14.04.2016	Czwartek	16.15 – 19.00	Minicentrum Konferencyjne (Luwr)
15.04.2016	Piątek	10.15 – 13.00	Minicentrum Konferencyjne (Luwr)