

GEOLOGY AND ECOSYSTEMS

Edited by
Igor S. Zektser



Springer

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Edited by

Igor S. Zektser

Russian Academy of Sciences

and

Brian Marker

Minerals and Waste Planning Division, UK

John Ridgway, *British Geological Survey*

Liliya Rogachevskaya, *Russian Academy of Sciences*

Genrikh Vartanyan

Russian Academy of Natural Sciences



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Contributing Authors

Alan Geoffrey Milnes, GEA Consulting, Chemin des Rochettes 58, 2012 Auvernier, Switzerland

Anatoly I. Krivtsov, Central Research Institute of Geological Prospecting for Base and Precious Metals, 117545, Varshavskoye sh., 129 "B" Moscow, Russia

Andrey Ye. Shapovalov, Water Problems Institute, Russian Academy of Science, 3 Gubkina st., 119991 Moscow, Russia

Anna P. Belousova, Water Problems Institute, Russian Academy of Science, 3 Gubkina st., 119991 Moscow, Russia

Arkady I. Sheko, Russian Research Institute for Hydrogeology & Engineering Geology, Zeleny village, 142452, Moscow region, Russia

Audrius Zvikas, Institute of Botany, Zaliuju ezeru 49, LT-08406, Vilnius, Lithuania

Brian Marker, Minerals and Waste Planning Division, Office of the Deputy Prime Minister, Head of Non-Energy Minerals and Environmental Geology Branch, Zone 4/A2, Eland House, Bressenden Place, SW1E 5DU, London, UK

Genrikh Vartanyan, Russian National Research Institute for Hydrogeology and Engineering Geology, Former-Director, Zeleny village, 142452, Moscow region, Russia

He Qingcheng, Department of Groundwater monitoring, China Institute for Geo-Environmental Monitoring, Director, Dahuisi 20, Haidian District, 100081, Beijing, China

Igor S. Zektser, Water Problems Institute, Russian Academy of Science, 3 Gubkina St., 119991 Moscow, Russia

J.H. van den Berg, Faculty of Geosciences, Utrecht University, The Netherlands, PO box 80115, 3508 TC Utrecht

John Ridgway, British Geological Survey, Kingsley Dunham Centre, Keyworth Nottingham, NG 12 5GG, United Kingdom

Jonas Satkunas, Geological Survey of Lithuania, Ministry of Environment, Deputy director, S. Konarskio 35, LT-2600 Vilnius, Lithuania

Jose A. Centeno, U. S. Armed Forces Institute of Pathology, Washington, DC 20306-6000 USA

Julius Taminskas, Institute of Geology and Geography, Sevcenkos 13, LT-03223, Vilnius, Lithuania

Leonid I. Elpiner, Water Problems Institute, Russian Academy of Science, 3 Gubkina St., 119991 Moscow, Russia

Liliya M. Rogachevskaya, Water Problems Institute, Russian Academy of Science, 3 Gubkina St., 119991 Moscow, Russia

Marek Graniczny, Polish Geological Institute, Centre of Geological Spatial Information, Head, 4 Rakowiecka Street 00-975, Warszawa, Poland

Naum G. Oberman, Mining and Geological Company "Mireko", Komi Territorial Centre for State Monitoring of Geological Environments, 75, Gromova St., Syktyvkar, 167983, Russia

Nina M. Novikova, Water Problems Institute, Russian Academy of Science, 3 Gubkina St., 119991 Moscow, Russia

Olga A. Aldyakova, Water Problems Institute, Russian Academy of Science, 3 Gubkina St., 119991 Moscow, Russia

Olle Selinus, Sweden Geological Survey, Head of Geochemical Division, Box 670 SE-751 28 Uppsala Sweden, Villavagen 18

Ricardas Paskauskas, Institute of Botany, Zaliuju ezeru 49, LT-08406, Vilnius, Lithuania

Richard E. Riefner, Jr., 5 Timbre, Rancho Santa Margarita, California 92688, USA

Roald G. Dzhamalov, Head of Lab., Water Problems Institute, Russian Academy of Science, 3 Gubkina St., 119991 Moscow, Russia

Robert B. Finkelman, U. S. Geological Survey, MS 956, Reston, VA, 20192 USA

Roy J. Shlemon, R.J.Shlemon & Associates Inc., Geological & Environmental Consultants, PO Box 3066, 92659-0620 Newport Beach, California, USA

S.Y. Treshkin, Institute of Bioecology, Uzbek Academy of Sciences, Berdacha pr. 41, 742000, Nukus, Uzbekistan

Tatyana Balyuk, Water Problems Institute, Russian Academy of Science, 3 Gubkina St., 119991 Moscow, Russia

Viktor T. Trofimov, Department of Engineering and Ecological Geology, Faculty of geology, Moscow State University, Leninskie gory, 119899, Moscow, Russia

Vladimir M. Shvets, Faculty of Hydrogeology, Moscow State Geology Academy, Mikluho-Maklya, 23, GSP-7, Moscow, Russia

Vladimir S.Krupoderov, Russian Research Institute for Hydrogeology & Engineering Geology, Zeleny Village, 142452, Moscow region, Russia

W. J. Langston, Marine Biological Association, Plymouth, UK

Zhanna V. Kuz'mina, Water Problems Institute, Russian Academy of Science, 3 Gubkina St., 119991 Moscow, Russia

Foreword

This book was prepared for publication by an International Working Group of experts under the auspices of COGEOENVIRONMENT - the Commission of the International Union of Geological Sciences (IUGS) on Geological Sciences for Environmental Planning and IUGS-GEM (Commission on Geosciences for Environmental Management).

The main aim of the Working Group "Geology and Ecosystems" was to develop an interdisciplinary approach to the study of the mechanisms and special features within the "living tissue - inert nature" system under different regional, geological, and anthropogenic conditions. This activity requires international contributions from many scientific fields. It requires efforts from scientists specializing in fields such as: environmental impacts of extractive industries, anthropogenic development and medical problems related to geology and ecosystem interaction, the prediction of the geoenvironmental evolution of ecosystems, etc.

The Working Group determined the goal and objectives of the book, developed the main content, discussed the parts and chapters, and formed the team of authors and the Editorial Board. The Meetings of the Working Group (Vilnius, Lithuania, 2002 and Warsaw-Kielniki, Poland, 2003) were dedicated to discussion and approval of the main content of all chapters in the Book.

Rational and sustainable development of society requires an ever-growing exploitation of natural resources, among which mineral and water resources play a dominant role. During recent decades, in many regions of the world, we have observed a high rate of human invasion into our geological structure, mainly through extraction of minerals, hydrocarbons, groundwater, etc. These impacts, together with day-to-day human activity, cause destruction to the Earth's surface and near-surface environment and

upset the balance of sustainable development. In turn, due to increasing anthropogenic impact, the geological components, which serve as the basic substrate and foundation for all ecosystems, is changed from its natural original state and the relationship between the "living tissue and inert nature" (i.e. relationship between the biosphere and the geosphere) is significantly affected.

The book is devoted to a poorly developed, barely broached, problem related to different aspects of the relationship between biological communities of the Earth and objects of inorganic nature or the geological environment. In this respect, the experience of many geological schools of the world gives a quite new understanding of the real scales and the inherent link between independent components of our planet, such as lithosphere, vegetation and animal worlds and, at last, human society itself.

At the present, in spite of the abundance of publications devoted to environmental problems, our knowledge of the mechanisms and magnitude of natural interactions between living tissue (the biosphere) and inert geological materials (the geosphere) is still lacking. Available information on the influence of different geological phenomena on human society is often only schematic and requires more scientific substantiation. For example, it would be enough to mention poorly grounded opinions, currently available in the ecological-geological literature, on the inferred minimal harmful impacts of the injection of highly toxic and radioactive liquid wastes into geological structures (with unclear environmental consequences). Special attention is given to the subtle mechanisms that govern the influence of the atmosphere's composition on the evolution of ecosystems, and on permafrost development and degradation in relation to biological communities etc. These problems are the subject of much controversy in scientific communities and the general public.

This book includes an analysis of the relationship between the different geological, hydrochemical, hydrogeological, and engineering-geological processes and the processes within surface ecosystems. The analysis of specific interactions between the lithosphere and biosphere provides an integrated concept of the role of the geological environment in the evolution of the biosphere. The practical significance of the book is reflected by the analysis of modern engineering activity associated with the mining of minerals, excessive groundwater withdrawal, disposal of industrial and domestic liquid wastes (including radioactive wastes) and their impacts on all components of the environment.

The book includes a scientific approach to the complex monitoring of the environment under different natural and anthropogenic conditions, including the monitoring of permafrost regions. An important part of the book is the analysis of the "water factor" impact on ecosystems and sustainable

development. In many regions, depletion of water resources and the impact of water quality on human health must also be taken into account. Influences of intensive groundwater extraction on river flow, vegetation and land subsidence are also considered in the book.

The unique outlook of our book is based upon a multi-aspect discussion of the most significant geoenvironmental factors that book exert an influence upon habitat conditions and stimulate or, on the contrary, hold back, human development. A great number of examples from different countries are given, illustrating a close link between the geological environment and the biota on our vulnerable Planet.

The group of authors includes a wide range of specialists: geologists with different specializations, ecologists, geographers, and specialists of neighboring sciences studying the interaction between different components of the environment. The complete list of authors and co-authors includes 34 authoritative and highly-qualified specialists from 11 countries. All chapters in the book were edited by the members of Editorial Board.

I feel compelled to emphasize the great goodwill and attention extended to each other among the authors and editors who promoted the successful completion of the book.

In this book, complicated and multi-aspect material is presented in a systematic and acceptable form, and can be a useful building block for the formation (or strengthening) of a fundamental nature conservation concept, which would serve as an impetus for sound and rational use of natural resources of the Earth.

The book covers a broad audience of readers. It is also intended as a professional update for environmental scientists, analysts, environmental health care professionals, geologists, ecologists, hydrologists, and other professionals with an interest in the Earth's environments and with environmental protection.