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GEOETHICS: THEORY, PRINCIPLES, PROBLEMS

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The monograph contains the first systematic exposition of main provisions of the new scientific field of ethics – geoethics, analyzing its status and considering its place in the system of contemporary scientific knowledge. Particular attention is paid to the development of moral foundations of relations in the system of "human being – inanimate nature", arising from the scientific research of the Earth and its mineral resources, practical geological exploration, mining and utilization of mineral resources, as well as from the use of mineral resources while constructing and operating the underground facilities not related to mining.

For specialists of research institutes, university professors, employees of the administrative apparatus, legislative authorities, developers of a variety of programs, concepts and scenarios for the development and utilization of mineral resources, geologists and workers of the mining industry.

Translated into English by Anna Berkutova, Anna Elyasova, Muhiddin Ganiev, Irina Tolmacheva.

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FOREWORD TO THE SECOND EDITION

Publishing of the first edition of monography "Geoethics: theory, principles, problems" in July 2012 has been objectively speaking predetermined. The monography was presented at a session dedicated to geotheics at the 34th International Geological Congress (Brisbane, Australia). Although the definition of geoethics has already been established in some dictionaries and encyclopaedias, as a science it only existed in a form of separate reports and theses. There were no consolidated documents on this topic in Russian or other languages, and there were just very few scientists in the world, not more than 50 in total, researching geoethics.

The situation has changed significantly within the last four years. First of all the definition of geoethics has been specified and broadened. Independent national geoethical societies and departments for geoethics under national geological societies have been established in many countries on all continents except Antarctica. On an international level these societies have been combined under the umbrella of two scientific associations: International Association for Geoethics – IAGETH (includes national organisations of 44 countries) and International Association for Promoting Geoethics – IAPG. Both organizations have been affiliated members of International Association of Geological Sciences – IUGS, since 2014.

During the last four years (which may seem quite a short time) the amount of accumulated knowledge has increased, geoehical situations, problems and dilemmas have been specified. New issues have been identified some of which are common for majority of countries, and others are specific to separate groups, communities and clusters of populations (NIMBY syndrome, feasibility of exploration of natural resources of the international seabed area, continental shelf, Arctic, Antarctic, other planets; fair distribution of profits from exploitation of natural resources, ethical dilemmas when predicting ever increasing catastrophical geological processes). When assessing effectiveness of

geological projects, it is necessary to apply not only usual economic criteria, such as profitability, commercial viability and profit margins – but also consider deep moral essence of the terms “subsoils”, “earth”, “natural resources”.

More and more often in practice, when implementing any projects related to subsoil use, it is needed to take into consideration essential features of mineral resources and its useful qualities: natural and geographical uneven distribution, exhaustibility, non-replenishability, scarcity and resource ownership by current and future generations.

We need to use geoethical principles and specific instruments when making executive decisions around subsoil exploration and use in order to avoid social conflicts.

The first edition of the monography was published in relatively small run (of just 300 copies) and only in Russian language, which significantly limited access to accumulated and systematised geoethical knowledge. Exactly for this reason, the second modified and extended edition is presented to the readers now in English language.

Finally, I would like to thank a number of people that contributed to the successful completion of this book. I am grateful to Anna Berkutova (Commercial Director Deputy, PL Drilling Rigs, ZBO Drill Industries, Inc., Orenburg, Russia), Anna Elyasova (Regional Manager & Business Advisor, Startup Direct, London), Muhiddin Ganiev (Freelancer, Tadjikistan), Irina Tolmacheva (Director’s Assistant, Energy Institute, Higher School of Economics, Moscow, Russia) for taking the time to translate the whole book in English. Also, many thanks to my husband Sergey Nikitin, who kindly read and helped editing this book. I must thank President of International Association for Geoethics, Prof. Jesus Martinez-Frias and Mr. Vladimir Smeliy for their continuous support of this project.

INTRODUCTION

During the last two decades the idea of Vladimir Vernadsky, that "we live in a time, when human effect on planet Earth can be compared to the effect of geological forces" became reality. Natural evolutionary processes have become secondary. Not only human actions have an impact on planet Earth and the processes happening to it, but the scale of human impact has become enormous. Gigantic growth in population, fast speed of scientific and technical progress as well as industrial development have led to massive consumption growth and even increase in deficit of natural and mineral resources. Nowadays society is very much dependent on materials and energy extracted from mineral resources.

At the same time we have realised how unique planet Earth is, the planet itself and its geological shells, and essential features of its mineral resources – exhaustibility, non-replenishability, scarcity and resource ownership by not only current but also future generations.

In the context of globalisation and cyclical economic downturns general philosophical understanding of human relationship with geological environment becomes increasingly important. It is essential to understand relationships between people in such areas as planetary research, exploration and use of planet Earth's subsoils and minerals contained in them, mineral processing, protection of mineral resources, efficient and ethical use of profits from exploitation of mineral resources, protection of biodiversity and prevention of inorganic pollution of our planet.

The most important part of philosophical knowledge – ethics, as the teaching of morality and moral foundations of social relationships – should play the main role here. Such key concepts as freedom of choice, fairness and responsibility, obligation and consciousness, contribution, integrity and humanity shall be the basis for addressing geological situations, problems and dilemmas.

Geoethical ideas and ideals are aimed at spiritual development

of personality and are against self-destruction of civilization. Progressing in our technological evolution we do not quite understand its limits. The real threat lies in continuous unjustified technological progress, for which more and more mineral resources are needed. Our planet will not be able to handle it. In order to avoid the catastrophe, we all need to change our attitude.

Nowadays it is necessary to combine the efforts of the world geological and philosophical communities to research and form a system of moral norms of human behaviour. It is important to define these norms for any social or professional activity, including those involving specialists engaged in research, exploration and exploitation of mineral resources. We need to provide realistic and efficient support to civil society and government of each country in creating ethical and transparent practice of subsoil management, improving the effectiveness of subsoil research, regeneration of mineral reserve base, and making sure the mineral resources are being used taking into account their exhaustibility, scarcity and resource ownership by current and future generations.

This document is the first attempt to summarise and conceptualise the knowledge that has been accumulated by still quite "young" discipline – geoethics.

CHAPTER 1

GEOETHICS – THE MODERN PHILOSOPHICAL BRANCH IN GEOSCIENCE

1.1 HISTORY OF GEOETHICS

Different categories as differentiation principles can be considered in development of models of promotion of geoethical awareness. As a form of social conscious, morality is traditionally considered a complex of norms that determine the responsibilities of humans in relation to the society, other people for a person (individual) is a member of the society. At each stage of its development, morality has been expanding the categories, which it belonged. For instance, the ethical rules of Ancient Greece did not apply to the slaves who were treated as human animals. By abolition of slavery, ethical categories were applied to a human being and society.

During the era of Enlightenment, the idea of the "kingdom of intelligence" – a hypothetic future of the conditions of the society and its interaction with the nature, where human intelligence would take the priority role, was first introduced. While nobody would have thought of any global environmental problems, the Enlighteners gave the world an idea, penetrated by the belief in human brain that is intended to ensure the progress of the society. However, the "brains of the Enlighteners" appeared to be neglected and development of capitalism has lead, in its sense, to formation of industrial-consumer values.

In 1915, German theologian, philosopher, Nobel Prize winner Albert Schweitzer, expanded the boundaries of the use of moral relations. Once, when at sunset, he slowly floated in a small boat in the Ogove River in Africa and watched a majestic scene of bathing of hippopotamuses, he imagined a slim system of ethics, whereby the animals had their own positions like humans and the basics of such system was the thought of "Piety in front of life" that struck him. According to the philosophic concept that Schweitzer defined, ethical treatment of all living creatures would end the duty of humans

in relation to the surrounding world. He wrote: “The mistake of all previous ethics variations was that one had to consider relation of a human to another human being, while in reality, we are talking about how a human treats everything that surrounds him” and “He (human being) will become ethical only when life as it is, lives of animals and plants will be sacred to him like the life of a human being, and when he will devote himself to life that is in disaster. The universal ethics of ruefulness only, the responsibility for which has no boundaries in relation to all living, can give an opportunity to reason ourselves in brain/thought”[152, 153].

The shortfalls of A. Schweitzer’s ethics were limitation of the morally important objects by higher animals and lack of any rules of solution of ethical situations, ethical problems and ethical dilemmas.

In 1920, Russian biologist V.I. Skuchaev developed the theory of biogeocenose, according to which biogeocenose is a homogenous area of the earth surface with certain composition of living (biocenose) and inorganic (near Earth atmospheric layer, solar energy, and soils) natural components, united by substance and energy exchange into a single natural complex. The complex of biogeocenoses forms the biosphere of the Earth [166, 167].

In 1922-1923, the scholar from remote and mysterious Soviet Russia Vladimir Vernadsky gave lectures in geochemistry at Sorbonne. At Sorbonne, it was the first time when he formulated the thesis on geological role of humans and humanity, which was later published in his works [173, 174, 175]. V.I. Vernadsky’s firm belief was that our planet has stepped into a new era of development, where homo sapiens plays the determinant role, both because of its unprecedented scale and his impact to the planet of Earth like the effects of geological forces, any of his actions and inaction is reflected on the condition of the natural environment. The geological activity of humans is obvious and indubitable. What happens if a little part of the fantastic strength destructive forces that humans have is initiated? Now humans are capable of destroying the Earth, but the reality puts a great challenge in front of him: can humans turn the Earth into a blossoming garden? [174].

Two young Frenchmen E. Le Roy* и and P. Teilhard de Chardin** were among the listeners. In 1927, preparing his own lecture course in philosophy at College de France in Paris, E. Le Roy was first to introduce the notion "noosphere", as a qualitatively new state of the biosphere, qualitative new driving force of evolution. Noosphere (Greek. νόος – brain/intellect, σφαῖρα – sphere) – an area of the planet, covered by sensible human activity. In his lectures and in his works "The need for idealism and fact of evolution" (1927), "Origin of humanity and evolution of intellect" (1931), E. Le Roy noted that the idea of noosphere developed under the influence of V.I. Vernadsky's lectures, where the occurrence of life was considered as a single entity. "The great geological literature lacks a related article of biosphere, which is considered as a single entity, as a naturally determined occurrence of the mechanism of the planet, its upper region – the sphere of the Earth". The very idea of the entirety of all living creatures, and all inorganic substances, and complex interrelation of living and inorganic and "sluggish" gave real revolutionary colour to V.I.Vernadsky's conclusions. This idea – of the entirety – triggered in Le Roy the conclusion on combination of the intellects of all people, represented by individuals, who are different, sometimes contradictory to each other, but nevertheless, can also be a single entirety, alongside with the lithosphere – complex of sluggish/fossil mother and biosphere – combination of living creatures – act as a separate factor of evolution, as a component of life on planet Earth.

During the second half of 1930's, after reviewing the works of E. Le Roy, V.I. Vernadsky wrote: "I accept Le Roy's idea of noosphere. He has further developed my biosphere. Noosphere was formed in post-Pliocene era – human thought covered the biosphere and is changing all processes from a new angle, and as a result the

* E. Le Roy (1870-1954), French philosopher, representative of catholic modernism. From 1921 to 1941 headed faculty of philosophy at College de France. Member of Academy of moral and political sciences from 1919, member of French Academy of Sciences from 1945. Introduce the term "noosphere", together with P. Teilhard de Chardin developed the concept of noosphere, trying to agree catholic dogmas with new data, accumulated by biology, anthropology, palaeontology. Catholic church included his works in the "List of banned books", and his ideas were criticised by Pope Pie X in encyclical Pascendi in 1907.

** P. Teilhard de Chardin (1881-1955) – French scholar-palaeontologist, philosopher and theologian, one of the discoverers of sinanthrope (ape man). Created philosophic concept of "Christian evolutionism", together with E.Le Roy developed the concept of noosphere.

biosphere energy increases." [175]. Actively developing the concept of E. Le Roy and P. Teilhard de Chardin on increasing of the role of intellect in development of civilisation, V.I. Vernadsky proposed an idea of noosphere becoming the main direction of development of humanity as a base of its future survival. He believed in human sense (intellect), which obliges us moving to very different relationships with the Nature. Not to fight it, as we had been doing until recently, no to melt over to be "pious" pre-civilisation balance of humans with the nature, not to idealise him, but to systematically even our relationships with the environment, to assist in improvement of the mechanism of single gigantic living system thus making possible the transfer from biosphere to noosphere.

It was not a simple step to take for human society to think about human relation to other life forms in the way of ethics. For all the time of their existence (this is about 2 million years, according to contemporary information), the humanity really thought that exploitation of biological resources was right for it supplies the vital needs of Homo sapiens, and lies outside the boundaries of morals. And only for the last hundred years, there has been some two-way traffic: development of Schweitzer's "piety with life" in social conscious thus its rights for existence and preservation of all biological forms of life, on one hand and awareness of human species as an element of ecosystems on the other.

In late 1930's the Benthamites and conservatives of USA initiated a burning discussion on the methods of preservation of the nature. The Benthamite approach supporters proposed a concept of preservation that assumed temporary preservation of selected areas of wild life, which would be reused for economic needs after rehabilitation. While the supporters of anti-Benthamite concept proposed complete conservation of most vulnerable and valuable areas of wildlife. American environmental scientist Oldo Leopold was a representative of conservatism. In his assays collection "A Sandy County Almanac", published after his death, explained the Land Ethics ideas. "The initial ethics assumed relationship between individuals; further additions are associated with relationships of an individual and the society. But there still does not exist the ethics that regulates the relationships be-

tween humans with the Earth, with animals and plants that live on the Earth. Like Odyssey's bond-maids, the Earth is still considered as a property and all relationships with it are still based on consumer point of view that assume only rights without any obligations", – wrote Leopold [90].

As opposed to A. Schweitzer, A. Leopold did not apply ethics to individual species, but to species and societies, and to the Earth as well* (an inorganic object in general understanding). According to the Land Ethics, humans should not abolish or contribute to dying off species, heedlessly mix local and exotic species, extract endless energy from subsoil and liberate it at household, dam up or contaminate rivers. This, ethics was applied to the third element in surroundings of humans. Such expansion radically changes moral approach of humans to the Earth: Land Ethics turns Homo sapiens from conqueror of the land community into a simple member and citizen of such community. The economic system of values that dominates our relationship with the Earth does not yet help understanding non-economic types of value: the nature protection system, based on economic egoistic interests, is hopelessly unilateral. It tends to ignore and this gradually abolish many earth community components, which do not have any commercial value, but which (as far as we are aware) are extremely important for unimpaired functioning". Leopold states that such polarisation in economic and environmental paradigms exists in all sciences, in whatever way related with study of the planet – wild life biology, forestry or agronomy. In the economic model, the value of the Earth is reasoned by its resource or instrumental value.

According to statement by the English philosopher J. Locke in his theory of occurrence of private property, the nature itself does not have any internal value, and using their labour humans can transform the concealed resource value of the Earth into useful products. By way of cultivation, people must "liberate" as much values from the Earth as possible. While A. Leopold approached the issue of preservation of nature as "a moral issue". He treated the Earth not only as stores of re-

* Here A. Leopold took the ideas of Russian philosopher P.D. Uspensky (1878-1947) as bases, who stated that everything in nature owns its own intellect: "there is nothing dead or mechanical in nature… the life and feelings should exist in everything"; "a mountain, tree, fish, a drop of water, rain, plane, fire – each in isolation should own its own conscious"

sources for humanity, but he looked at it as a living matter, which humans are closely connected to. And in his ecological model, the value of the Earth is higher and wider than the economic model. A. Leopold called this "the philosophic value" [50].

He took the Earth as some "collective organism". It feeds humans and forms their culture. People are responsible for preservation of the Earth's health. Not only the lives of existing, but also future generations of all living creatures who live on the planet are dependent on her health. Humans must cardinally review their approach to the nature. Humans must change from the conqueror and parasite into "citizens of biosphere". Humans must realise the fact the Earth is a collective organism, and they are part of it themselves. Parts of this organism not only compete with each other but also cooperate and work together. As the higher creature, humans are capable of regulating the competition and cooperation processes, but they have no rights to abolish such. For humans, wild nature must become a laboratory for studies of the health of the Earth. This science about the health of the earth is at its initial stage of formation. The land ethics is also forming in parallel. It "expands the boundaries of commonness/generality to include soils, water, plants and animals (collectively we call them the Earth)". According to A. Leopold, it is necessary to understand the fact that everything that exists in Nature is good irrespective of whether we understand it or not. All creatures, living and inorganic (in common understanding of such), have the right for existence and self-fulfilment. A. Leopold proposed a concept of commonness/generality, which is an integral part of the Land ethics. He clearly understood that "of course, the Land Ethics cannot prevent changes, management and use of these "resources", but it asserts their rights for continuous existence in the natural condition". Leopold's idea served the base for such independent trend of studies as ecological ethics (Figure 1) that deals with the norms of interrelations between humans and the nature and moral bases of use of nature.

In 1940's and 1950's Americans could not treat A. Leopold's proposals with any enthusiasm. The calamities of the Great Depression grew into the World War tragedy. The post war decade was the time for active construction of houses and families. Maintaining the integ-

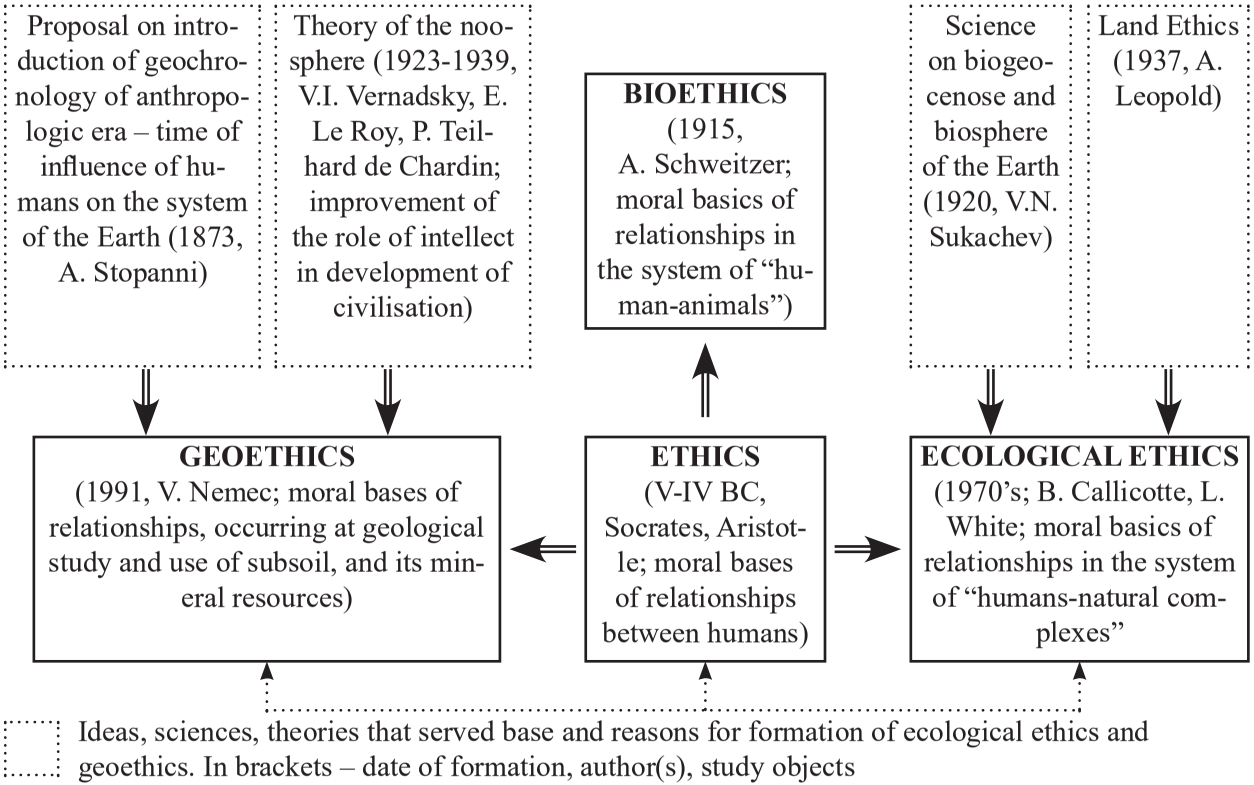

Figure 1. **Basics and history of formation of geoethics**

rity, stability and beauty of ecosystems, offering basic rights even to useful species was almost a meaningless phrase for the first generation of flourishing Americans; ecology was an abstract science to such people. A. Leopold's ideas did not even get the support by majority of ecologists. A. Leopold himself realised that accepting his Land Ethics would depend on changes of far ago established positions and did not express any optimism in relation to the potential of possible changes in social conscious.

Nevertheless, in the following 20 years, a sharp growth of ecological reality awareness created a favourable climate for formation and improvement of positions of the ecological ethics. Should A. Leopold continue to live after 1948, he would probably be surprised and satisfied by occurrence of the ecological ethics, growth of eco-philosophy and even occurrence of such journals like "Environmental Ethics" and "Ecology Law Quarterly", would eagerly read Christopher Stone's assay "Should trees have standing? Toward legal rights for natural objects", he would welcome introduction of environmental protection legislation in various countries, laws on protection of subsoil and preservation of geological objects that are guarantors of the case the some representatives of living nature have rights for living and freedom, while some cliffs and landscapes would be preserved for future generations. Though A. Leopold died in doubt in any possibility of expanding the ethical boundaries, the following generation of environmentalist scholars and philosophers made the ideas of the rights of natural objects more and more popular and try to expand the altruism field.

Being an active supporter of ecocentric ideas of O. Leopold, B. Callicott developed them into his own ecocentric ethics model. According to B. Callicott [27-30], ecosystems are more important than living species, and the basics for moral thinking must be assessment of natural sense for their sake irrespectively of any specific characteristics, which they may have (for instance, internal value, ownership, divine value, etc.).

The "deep ecology"*, a movement that was formed in 1972 that proposed not an integral philosophy of nature, but some philosophic

* This term was first proposed by Norwegian philosopher Arne Naeiss.

way to create its own ecosophic version, was based on eight ecobiocentric ethic theses:

1. The benefit and flourishing of life on the Earth has its value as it is (synonyms: its own internal value, true dignity, self-value). These values do not depend on their usefulness to people.
2. Abundance and diversity of life forms helps implement these values and are valuable on their own.
3. People have no rights to reduce the abundance and diversity of life, with the exception of satisfaction of vital needs.
4. Flourishing of human life and culture, as well as flourishing of life of other creatures, requires significant reduction of population of people.
5. Current interference of humans into nature is excessive and the situation is getting worse rapidly.
6. Changes are required in the policy and efficient impact on basic political, technological and ideological structures.
7. Ideological changes – the essence is mainly in the changes in assessment of the quality of life – life with feeling of internal value of the entire nature, but not the tendency to higher consumer standards.
8. Those who are prepared to accept these principles, should directly and indirectly try to implement such into life [107, 108].

According to A. Naeiss, nature cannot be treated simply as a source of resources for existence of people, "deep ecology" must promote the striving for identification with nature so that the damage done to it is perceived as damage to humans themselves; it is necessary to respect the right of all life forms for living and flourishing, emphasise with other substances, aspire to maximum diversity of life of people and other species.

Commenting general thesis of "deep ecology", A. Naeiss explains that in para 1 he means not only about biological forms of life, but also all components of the ecosystem – rivers, mountains, seas, etc.

This means that in 1970's, due to aggravation of global ecological crisis, some worldview basics of ecocentrism and ecothinking were formulated. The dominating role is now played by the principle

of ecologism, reorientation of processes of development of scientific awareness and activity of the society towards their ecologisation, in other words - taking into account the laws of wild nature, and expanding the traditional boundaries of ethics to biological and non-biological objects (water, air, landscapes).

In early 1990's, while enumerating the categories, which the moral approaches should be applied to, the philosophers to some extent mentioned such systems of the earth (geosphere) like biosphere, hydrosphere, atmosphere and soil cover. There was only one step left to apply the use of moral norms to interrelations of humans with the last system of abiotic nature system – subsoil and mineral resources contained in them. And this step was taken in 1991 at the symposium in Krakow (Poland), dedicated to the 70th anniversary of professor Adam Trembetsky, well known Check scholar and organiser of science, doctor Vaclav Nemec made a speech with his report "Technical and ethical problems of computer modelling of open pit mining activities", where he was first to declare the ideas of development of ethical principles of reproduction and use of mineral resources, which should have international nature*, calling such scientific trend "Geoethics". "My inspiration of geoethics was not associated with the ideas of Aldo Leopold, who called them Land Ethics and which he compared with animate nature. My inspirations are business ethics and an idea to formulate a special ethics for geologists and miners; Geoethics should mean the same for inanimate nature as the bioethics does for animate life. In addition, I would love to formulate Geoethics that is independent from Ecoethics, though efforts of these two sciences coincide in certain situations, but Ecoethics is indubitably closer to A. Leopold's ideas" (quotation from a private letter from Vaclav Nemec to the author; we kept the style unchanged).

There had been attempts to date formulation of Geoethics in 1973, when Antonio Stoppani, Italian geologist and palaeontologist proposed an idea of introducing the anthropologic era into the geochronological scale - an era of domination of Homo sapiens that significantly affected to the natural environment. In 1980's, this idea was

* The report was published in "The materials of the symposium" No 4, pages 99-104 ISBN 83-900110-1-8)

captured by Eugene Stoermer, American ecologist, and in 2000, it was popularised by Paul Crutzen, Nobel Prize winner for chemistry as a proposal of the Commission for Stratigraphy of the Geological Survey of London to use the term "anthropocene" that indicates the geological epoch with the level of human activity that plays a significant role in the Earth ecosystem [40]. We should note that these and similar statements did not mean formulation of Geoethics in the rank of a scientific discipline. This was more occurrence of ecological way of thinking. While formulation of ecological ethics was based on awareness of significance of the impact of human activity to natural systems and crust of the planet, together with this awareness, Geoethics was originated by the following assumptions:

– accumulation of geological knowledge that has facilitated understanding of geographic irregularity of distribution of mineral deposits, their limitation in volume/size, exhaustibility, non-renewability, potential for high economic, environmental and social risks that are associated with mining;
– occurrence of ethical problems like fair distribution of income from mining of minerals, the minerals belonging not to contemporary, but also future generations, responsible (irresponsible) subsoil use, acceptability (unacceptability) of destruction and disappearance of geological objects and systems that are classified as non-renewable resources, ethical collisions that arise in prognosticating geological calamity processes (eruptions, earthquakes, landslides, floods) etc.

Thus, determination of Geoethics as a science, classification of Geoethics into an independent philosophic discipline owes to Vaclav Nemec. He and his associated and followers from different countries – G.S. Gold, M.A. Komarov, N.K. Nikitina (Russia), L. Nemcova (Check Republic), N. Nishivaki (Japan), A. Trembetsky (Poland), J.-M. Frias (Spain) etc. specified the objectives of Geoethics, objects and targets of its studies.

The geoethical situation, problems, dilemmas, the results of theoretical studies and their practical application are regularly discussed at meetings on the Geoethical section of biennial international symposiums "Mining Pribram" (Check Republic) since 1992 (Table 1).

Since 1997, an independent Geoethics section has been active within the framework of biennial international conference "New ideas in Earth sciences", which is organised by the Russian State Geological Exploration University (Moscow).

Since 1996, at the international geological congresses held once in four years, there is an independent Geoethics section under the chair of the Geoethics founder Vaclav Nemec (Table 2).

From 2009, the geography of conferences expanded. Discussions of Geoethics issues are included in the agenda of annual Assembly of European Federation of Geologists – AFG), forums of some national geological societies (Italy, Columbia, Mozambique, Spain, and etc.)

In 2012, according to the results of the symposium "Geoethics", held within the framework of the 34 International geological congress (Brisbane, Australia), a decision was made on foundation of two international associations: International Association for Geoethics – IAGETH) and International Association for Promotion of Geoethics – IAPG), which are affiliated members of the International Union of Geological Sciences – IUGS) since 2014.

As at January 1st 2016, IAGETH has 44 national societies of professionals in the field of Earth sciences of the following countries: Algeria, Argentine, Australia, Belgium, Botswana, Brazil, Canada, Cape-Verde, China, Columbia, Costa-Rika, Cuba, Ethiopia, Greece, Egypt, Hungary, India, Iceland, Italy, Japan, Kazakhstan, Kenya, Libya, Malawi, Mexico, Mongolia, Morocco, Mozambique, Niger, Nigeria, New Zealand, Namibia, Portugal, Romania, Russia, Sri-Lanka, Spain, South Africa, Tajikistan, Tanzania, United Kingdom, USA, Venezuela, Yemen, Zimbabwe.

The results of these conferences, symposiums, and congresses where the Geoethics sectors run their activity, is significant growth of both theoretical knowledge and the results of applied research work.

However, despite the fact that more and more scientists have to some extent considered geoethical issues in their research works, Geoethics still looked a little-known scientific discipline. Partly this was associated with lack of foundational monographs. Prior to publication of First Edition of this book in July 2012, where it was the first time to show a systemic explanation of the fundamental principles of Geo-

Table 1

Reports, published in collections of geological symposiums in Pribram (Check Republic)

(*According to Vaclav Nemec*)

Parameters	1992	1994	1996	1998	1999*	2001	2003	2005	2007	2009	2011	2013	2015
No of participating countries	5	7	13	7	9	9	11	10	10	6	18	16	18
No of participants	5	9	13	16	16	18	18	20	21	18	60	30	28
No of reports	9	33	38	24	27	30	25	26	27	19	24	29	39
Accumulating No of reports	9	42	80	104	131	161	186	212	239	258	282	311	350

Table 2

Reports, submitted at international geological congresses

No of international congress	Year	Town (country)	No of reports		No of special symposium on Geoethics
			Total	Including, No of verbal reports	
29	1992	Kyoto (Japan)	3	2	–
30	1996	Beijing (China)	5	4	21.3.1
31	2000	Rio-de-Janeiro (Brazil)	10	6	26.1
32	2004	Florence (Italy)	24	7	8.03 8.04
33	2008	Oslo (Norway)	18	12	IEE-007 IEE-008
34	2012	Brisbane (Australia)	19	16	2.4

* In 1999 the symposium was held in Prague

ethics, there had been some reports only (thesis of reports) on various trends of geoethics, represented at conferences and congresses.

At its initial stage of development of Geoethics as a new scientific trend, it was important to formulate the notion "Geoethics" itself. During the many discussions, several different definitions have been proposed. M.A. Komarov understands "relation/approach of humans and society to the geological environment in different aspects of its occurrence" as the object of Geoethics. G.S. Gold considered Geoethics as a trend that studies "the possibilities of use of ethical principles with regard to the activity in the field of mineral resources" [54].

N.L. Shilin formulated a definition of Geoethics from the point of view of contemporary global problems. Based on the ideas of V.I. Vernadsky, E. Le Roy, P. Teilhard de Chardin, who separated a new planetary crust of noosphere (sphere of intellect/brain), he managed to make a compelling proof that noospheric thinking allows understanding the geological and ethical role of humanity in transformation of all other spheres of the Earth. From this point of view, according to N.L. Shilin, Geoethics combines a complex of ethical problems, associated with geological scientific studies, practical geological exploration works, mining and use of mineral-raw resources, being one of the most important components of the natural environment, by preserving the geo-diversity and geo-heritage, by development and implementation into practice of professional codes of conduct. One way or another, but today all researchers agree with the fact that Geoethics is a notion that includes moral principalities in relation to the Earth as a geological body, and to social and economic objects in all their diversity [50].

1.2 SPIRITUAL BASICS OF GEOETHICS

At all times, the Church had been the preserver of ethical norms. Even most of our contemporaries belong to this or that religion to obtain answers to those questions, related with understanding of the right (godly/righteous) and wrong (vicious) conduct and way of life. Often, moral behaviour of statesmen, political leaders take their origin from that world perception, which, though not directly associated with official Church, but are very close to religious.

In 1967, in his work Lynn White [176] made an attempt to answer the question "about historical roots of our ecological crisis" and came to a conclusion of existence e of dualistic ethical system in Judaism and Christianity traditions, according to which exploitation of people is not desirable, while exploitation of nature is not only acceptable, it is mandatory: "And in completion God created Adam, and after some thinking – he created Eve for the man not to be alone. The man gave names to all animals thus establishing his reign over them. God envisaged and planned all this exclusively for the benefit of the man and that he managed the world: no natural creature has other mission other than to serve the purposes of the man. Though the body of the man has been created from the Earth ash, he not simply is a part of nature – he had been created after the image and likeness of God… By contradicting completely and irreconcilably to Greek paganism and Asian religions, with the possible exception of Zoroastrianism, Christianity not only established dualism of the man and nature, but also insisted on the proposition that God's will definitely means that the man exploits the nature for the sake of his purposes. For a common person all this turned into very interesting consequences. In the antique epoch, each tree, each stream, each water flow, each hill had their own genius loci, their own protector-soul. These souls were accessible by the man though they did not resemble him at all: centaurs, fauns, Naiads (river-nymphs) – all of them had double faces. Before cutting a tree, digging a shaft, building a dam at a river it was important to tune the soul that owned certain situation into his favour and take care not to get deprived of his mercy in future. By abolishing the pagan animism, Christianity opened a psychological possibility to exploit the nature in the manner of indifference to self-feeling of natural objects".

However, there exist other readings and interpretation of Bible. For instance, according to G.S. Senatskaya [155, 156], Bible stresses on the uniqueness of our mission: "And God took the man and put him in the Garden of Eden (that obviously represented the Earth at that moment), to cultivate it and preserve it". In addition, the reason of the ecological crisis is that the man did not fulfil the instructions imposed on him. The Biblical ascertaining that God created the man "after his image and likeness" assumes that the man was created as a sensible,

free and thinking creature. Obedience was to be voluntary, no violence was assumed on the personality. The "tree of recognising the evil and good", to which the people had free access – is the proof of this. Had the man chosen obedience, he would have been granted the good eternal life. Otherwise, this was the choice of immorality and fall. If the first people on Erath, as opposed to the people living in our days, the harmonic life in integrity with God and creations (in the meaning both humans and the natural environment that surrounds him) would have been quite natural, but after the Fallal of Adam and Eve, a rapture had occurred between God and the man, which lead to damages in relations of the man with the nature. "Cursed is the Earth because of you, thy shall be eating from it with grief… It shall grow thorns and thistle for thy", - such were the consequences of the human disobedience.

There are commandments in Bible on protective care of flora and fauna, caring use of subsoil: "… thou shall not damage trees, from which one can find food and thy shall not exhaust surroundings", "thou shall crop your land thy land for six years and collect its produces, and in year seven leave it alone". Bible not only calls humans to reasonably manage the natural resources, but also suggests principles of sensible management [156]:

- Rental relationships principle. The Holy Writ stresses that everything that surrounds people is owned by God. Bible clearly explains the thought: "The land and everything that fills it belongs to God" (Genesis, 9:29; To Corinthians: 10:26). It is also written in it that all wealth in subsoil also belongs to God: "For all the land is mine" (Genesis 19:5), "silver is mine and gold is mine and jewellery is mine" (Book of Joel 3:5, Haggadah 3:8). This means that humans are more tenants (let it be a long-term rent) than being the owner. "The rent" means obedience to God's commandments, which call for sparing and adding to God's gifts.
- The principle of necessity and sufficiency. From the days of genesis of Jews from Egypt, God taught his people not to rush for excessive things and get satisfaction from what is available. By sending the manna from heaven, He warned the people: "Collect each of thou in the amount the he can eat" (Genesis 16:16). In addition, those, who did not believe in God's saying and collected

the excess manna, found the manna spoilt in the following day (Genesis 16:20). The Book of Proverbs says: "Have you found honey? Eat from it the amount you require not to be repleted with it…" (The Book of Proverbs 25:16), in other words, any excessive amount that is taken from nature will not bring benefit.

- The sparing principle. Contemporary aspiration to maximum utilisation of wastes has biblical justification. Gospel tells the story that Jesus, having fed thousands of people with a few bread, told his disciples: "Collect the remaining pieces to avoid loss of anything", and they "filled twelve boxes with pieces…, left from those who ate" (In: 6:12, 13; comp. from Matthew 6;34-43; 8:1-8,19).

All the previously mentioned tells us that moral norms, including in relation to nature, established in the Holy Writ, are the source and basics of modern Geoethics. High professionalism in subsoil use issues assumes both Geoethical and moral fundamentals, if one of these is not in place, it will lead to irreparable errors [155].

Catholic Church, who took the moral obligations for expressing their own point of view on vital social problems of humanity, periodically publishes Pope's social Encyclical Letters)*. The most important of these are *Rerum novarum* (On the basis of new events, 1891), *Quadragesimo Anno* (Year forty, 1931), Mater et Magistra (Mother and preceptress, 1961), *Centesimus Annus* (Year one hundred, 1991), were combined in Compendium** in 2004 along with formation and clarification of Christian social doctrine that contain ecological elements and ideas, called for stressing on the necessity of preservation of the surrounding natural environment as a fundamental ethic value (Part 10 "Preservation of the environment") [37]. These documents do not contain any concentrated instructions how to behave in this or that situation, they propose the main opinions on various issues of contemporary word.

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* Encyclical texts (Latin encyclical, from Greek. ενκυκλιος – circular) is main Pope document on various issues, addressed to the believers or bishops or archbishops of an individual country, second importance document after the apostolic constitution.

** Because social studies of catholic Church is represented in many different scattered documents, often unavailable to common public, in 2000-2004, on the order by Pope Joan Paul II, the Pope's Council "Justice and peace" prepared a Compendium of Social Studies of the Church that systematised and unifies the main ideas of these documents.

Limila Nemcova completed a detailed analysis of the Compendium from the point of view of Geoethics and ecology [113]. As opposed to any ideology, social doctrine of the Church is not a doctrine of political order, but of religious and moral order.

The basics of Part 10 mentioned above is primarily the following postulate of Catholic Church – God gave the Earth to all people without exceptions and any preferences. As a result of Divine creation, the Earth is not an enemy to people. On the contrary, relationships between humans and surrounding world - nature are a significant determinant part of its human identity. These relationships, in their turn, are the result of another, deeper relationship between humans and God. In his dialogue with God, a man finds the truth, which he takes inspiration, ideas and norms for planning of the future of the world from. This world was, is and must be a garden, which God had given to people for them to preserve and cultivate (paras 451-453 of Compendium). Thus, the key point that Compendium proposes is the following: the activity of people in relation to the Nature must be ethically oriented. However, such orientation is impossible if Nature is treated as an object of worship/cult only or as an unlimited field for technical activities. During the entire period of their existence, people had only one purpose – to achieve more and more favourable conditions of life, by investing huge amounts of individual and collective effort. With the help of science and equipment, today people have significantly expanded their reign over nature. But humans are not competitors of the Creator. By positively assessing the achievements of science and equipment as a whole, Catholic Church is confident that the achieved triumph of human race in his way of constant interaction of nature and people – is a sign of the beauty of Divine Providence and apotheosis of God's secret project [37]. At the same time, Compendium gives Christians a warning – technical achievement of humanity that gave them power over the Nature, may lead not only to prominence of humans, but also to their degradation.

1.3 FOUNDATIONS OF GEOETHICS. OBJECTS, SUBJECT AND OBJECTIVES OF STUDY

The etymology of the term "ethics" originates from the notion that indicates joint dwellings, living in which, according to the logic of things, required adherence to certain rules. The term was introduced by Aristotle to indicate the final part of his doctrine, which considers the orientation and methods of regulation of human behaviour. Aristotle determined ethics as a practical study of ways of achieving the desired targets by humans [8].

Ethics is a metascience discipline and has its own certain sphere of influence. Theoretically, in the world of geological processes and occurrences there should be no ethics at all: it is impossible to say that a lava flow (geosyncline, fault, megablock etc.) may behave amorally. However, ethics steps in in problem definition of axiological (practical) geosciences associated with analysis of value contents of deeds of humans that, as a rule, contradict and are ambivalent in their content.

Geoethics is a theory about ethical relations of humans with inorganic nature, based on the perception of this nature as a member of moral community, moral partner (subject), based on the principles of equality and equivalence of inorganic matter and on limitation of the rights and needs of humans in relation with inorganic nature. The mission of Geoethics is in implementation of the values approach, values criteria in practice of geological exploration and mining activities, use of mineral resources and preservation of objects of inorganic nature (geo-heritage) as opposed to self-interest and (individual, corporate, state) mercantilism.

The object of study of Geoethics is morals in the field of study of subsoil of the Earth and other planets that contain mineral-raw resources, in the field of reproduction of the mineral-raw base, mining and use of mineral-raw resources and useful properties of subsoil, while the subject of its study are pragmatic sciences for starting from and surpassing the latter, Geoethics can fulfil the noble role of regulating the behaviour of people in the system of "human - inanimate nature". As a science about morals, Geoethics studies the process of motivation of behaviour, general orientation of relationships in the

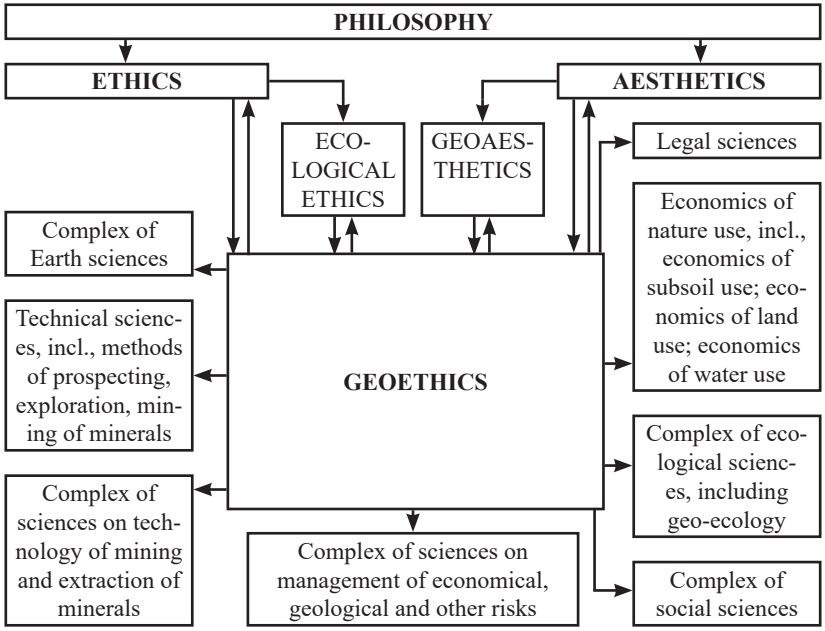

Figure 2. **Interrelation of Geoethics with other sciences**

said system, justifies the necessity and most expedient form of the rules of joint existence of this system, which humans are prepared to accept and fulfil based on voluntary intention.

Position and relation of Geoethics with other sciences is shown in Figure 2.

Morals in the field of study of subsoil of the Earth and other planets, reproduction of mineral resources and their use as it is, occurs in the history of the society when there is a freedom of choice, possibility of fulfilling these processes in a different way, by preferring this or that system of valuables. Such choice is only possible in accordance with some ideas, on the basis of contrapositioning of "true" and false targets owing to establishing of understanding of the true mission of the man by way of realising the position and role of humans in the nature system of the planet Earth.

For the period of its existence, being a short time for a science, there are several practical justifications for expansion of the moral

field to all objects of inorganic nature and all spheres of the Earth and other celestial bodies: lithosphere, hydrosphere, atmosphere, relief, landscapes, and the circumplanetary space. The subject of study of Geoethics is morals in the field of study and use of maximum large conglomerate of geological and geographical environments and their systems that cover any planet (and not only the Earth) as a single unit and that are combination of various of parameters of inorganic nature, which are in close indissoluble connection, while on the Earth they are involved in the globalisation process.

At the initial stage of formation of Geoethics as a scientific discipline (1992-2012), in the process of formulation of definitions, specification of objectives, purpose, objects and subjects of these categories, many scientists tried to maximise the extent of the list of each category, often, possibly, by incidentally including some objects and subjects of studies, purpose and objectives of ecological ethics.

There existed another extremity. Some philosophers did not see any problems that could be resolved using already existing ecological ethics* and directly refused Geoethics in its right for existence.

It is possible that in near future all applied ethical disciplines, related with study and use of organic and inorganic systems of the earth, will be combined into a single science – something like the Ethics of the Earth.

Jamais Caascio, American futurologist, known for his works on prognostics and development of moral norms of future life, defines the ethics of the Earth as "*a set of guideline principles, which should determine human behaviour and deeds that deal with large planetary systems, including atmospheric, oceanic, geological and ecosystems of flora and fauna. These guideline principles are especially necessary, if human behaviour and deeds may lead to long lasting, large scale and/or difficult to repair changes in planetary systems; but even local and surface changes should be considered through the prism of the Ethics of the Earth. The principles of the Ethics of the earth do not ban long term, large scale transformations, but require mandatory*

* It is indubitable that both geo-studies and more over geo-developments could be the subject of ethical regulation, but here there is nothing that could be studied in ethics of the researcher (science) or in ecological ethics, or in ethics of sustainable development" – from a private letter to the author (we have kept the style of the letter intact).

prognostication and accounting of consequences, including so called "secondary order effects", in other words undeliberate consequences, that are the results of interaction of the changed system with other connected systems" [31].

We should note another extremity, which represents attempts of breaking Geoethics into more isolate disciplines on names of minerals: ethics of hydrocarbons, ethics of ground waters, etc., which, the author thinks, has no potential for in such cases, there really is not any necessity in isolation of any new ethical regulators, while the objectives of such micro-disciplines may be resolved within Geoethics.

Geoethics is primarily based on perception of the planet Earth, its geological spheres, its subsoil, and all geological objects as the base of the life of humanity, on acknowledgement of equality and equivalence of inorganic matters, and on limitation of the rights of people in relation to inorganic nature. Within the framework of these new global ethical assumptions, humanity is trying to rethink the main issues of the entire complex of earth sciences. Combination of geoscientific problems (geographic unevenness of distribution of mineral deposits on the planet, exhaustion of mineral resources, constant growth of costs for discovery of such, natural and commercial risks for development, increase of the coverage area of protected natural territories etc.), main ethical achievement (responsibilities, rights and justice, responsibility of generation, religious beliefs in secular societies, etc.) and possibilities of such practical instruments like local and global geological knowledge, prognostics, scientific expertise of various projects and participation of citizens in decision making, allow formulating the following main geoethical postulates:

- natural, including mineral resources have specific internal properties that do not allow reflecting certain elements of their value in market prices or in any other similar utilitarian units of measure of value [178];
- geographic unevenness of distribution of mineral deposits on the planet requires using principally new global approaches to management and use of mineral resources, and to distribution of waste from development of such;
- exhaustion of mineral resources, limited volume and finiteness

of such cause the issue of access, rights of currently living and future generations for mineral resources; the decisions to be taken by national and regional governments may be initial cause for wars; at this stage of life it is necessary to develop international instruments of regulation of use of mineral resources, scientific expertise, including ethical expertise of decisions to be taken, wide public awareness of consequences of such decisions;

- the geography of world mineral resource mining is expanding: it at least depends on availability of mineable mineral deposits in a given territory, and it to larger extent is determined by social conditions and requirement of nature protection legislation of the given territory; moving mining centres to poorly developed counties has become a tendency;
- sustainable development assumes priority use of secondary resources, re-processing of which does not cause a destructive effect to all spheres of the Earth, which happens at initial (primary) extraction and processing of minerals.
- The nature, landscapes, biological diversity of species, subsoil should be treated not simply as objects of protection in the territory of mining and processing of minerals, they are primarily the objects of heritage for future generations [1].

The subject of study of Geoethics includes geoethical situations, geoethical problems and geoethical dilemmas.

Geoethical situations occur when there are two different points of view in relation to the issue of what is acceptable or inacceptable in a specific situation. For instance, as a whole, geoethical situations occur every time when a decision has to be made on commercial developing of a mineral deposit, if there are two equivalent objects, there are two (or more) options of its development methods. A fair decision in such a case would be based on a complex analysis of existing geological, economic, environmental and other information, on assessment of the objectiveness, reliability and completeness of information, drawing of conclusions on the basis of the above to facilitate a correct choice.

Geoethcal problems are more sophisticated than geoethical situations for they assume the presence of several possible ethical decisions. For determination of content and decision of the problem, it

is necessary to have time and collective common sense to determine the best option out of all available decisions for all interested parties.

For instance, the issue of acceptability of mining of offshore hydrocarbon resources. Annually growing needs in hydrocarbons cannot be satisfied from mining of continental hydrocarbon deposits only. But the accident at the Mexican Gulf Deepwater Horizon oil platform on April 20th 2010, when it cost lives of 11 people, sinking of the platform itself, and according to different estimates from 2.9 to 4.9 million barrels of oil was let go to the waters of the Gulf for four months resulting in a big environmental catastrophe in USA and neighbouring countries.

Less than one month before the accident, President of USA published the programme of developing the continental offshore shield area, which gave access to oil miners to significantly wide territories along the Southeast coast. USA banned mining at most parts of the offshore zone in 1981, and since American oil companies had spent much effort to try to persuade the government in the necessity of developing new resources.

The consequences of this accident will affect all participants of oil-and-gas industry, including the producers and consumers, local communities and government structures. These events remind us again that the oil-and-gas industry is a complex in its nature, and running business in this industry is associated with significant risks, and that, unfortunately, the risks can be brought to zero only by stopping all work in exploration and development of continental offshore area, and the needs of economy in energy sources would be covered by, for instance, alternative energy sources. According to a number of scientists, the mid-term potential does not have any reliable alternative to hydrocarbons anywhere in the world.

Exploration and development of offshore deposits can be continued only by keeping in mind the fact that from time to time, some problems will inevitably happen, cause damage to people, and have negative impact to the environment. In this case, the consequences would be increasing of oil mining costs due to additional costs for risks and expenses to be envisaged in developing hydrocarbon deposits in offshore areas, and delays of implementation of many projects,

which, in similar conditions, would be commercially not profitable or inacceptable for social or political reasons.

Subject to the territorial significance, different levels of geoethical problems can be differentiated: global, regional, local and private.

Geoethical dilemmas occur when, in any case, upon making any decision one of the sides incurs losses. For instance, for various reasons, when local population acts against mining of mineral resources in the territory of their habitat. In this case, it is necessary to choose the least of several evils, for no decision would be good for all. Often, dilemmas are caused in crisis situations, for instance, during natural calamities. So, during unprecedented fires in abandoned peat mines in Moscow oblast in the summer of 2010, when it caused serious contamination to the atmosphere (Maximum Admissible Concentrations were exceeded dozens of times), significant losses of forestry, human deaths, the Government of Russian Federation took a decision on emergency installation of dozens of kilometres of water lines from the Ob River to flood the peats. In addition, the old peat drainage systems, installed prior to mining activities, were not dismantled, while large amounts of water were pumped from the Ob River, which was already shallow due to the anomalous hot summer.

Even after complete control of fires, the abandoned peat mines are still potential causes of fires. In such conditions, a serious decision was taken on the necessity of rehabilitation of swamps in these territories to their initial state. The consequences are easily prognosticated (changes of flora and fauna, water sites and their circulation regime, and their positive consequences are not obvious, for under the motto of rehabilitation of the initial natural balance, the natural balance that has been established for the past decades would be changed.

CHAPTER 2

GEOETHICAL IMPERATIVE

2.1 BIOTIC AND ABIOTIC NATURAL OBJECTS

To-date, the life sciences have accumulated a great deal of data about evolution of the surrounding world. The Universe was created as a result of the Big Bang 13.7 billion years ago together with its time, space and substance. It successively underwent the inflation (superfast expansion) stages, isolation of the substance from radiation, the dark epoch, creation of galaxies and first generation stars, celestial nucleosynthesis of chemical elements, blasts of stars and formation of next generation stars in molecular clouds together with planet systems. Near the Sun, natural processes on the Planet of Earth that had been formed 4.56 billion years ago, resulted in biological organic life.

Life is a so sophisticated event that it can be defined in very general terms. It is a general rule to think that life (organic nature, living world) is the objects that have specific properties that belong only to them and that contrast from inanimate objects. There are no transition forms between animate and inanimate objects. However, we are aware that both animate and inanimate natures have the same physical laws. Sometimes, the necessity in food and possibility of reproduction of animate objects that are offered as differences are not quite correct. Food is only transformation of one type of energy into another and is observed as animate and in inanimate nature as well. Precipitation feeds rives, the rivers feed the seas and oceans, hurricanes are supported by concealed heat of condensation, energy systems of our civilisation feed different mechanisms with energy by consuming minerals like coal and hydrocarbons. The capability in reproduction is observed in inanimate nature as well. All chain reactions can be considered as reproduction of products of destruction for they lead to exponential growth of their number [50]. Autocatalitic processes (form of inductive processes where the final product serves as a catalyst element of its own production; these processes were first described by Nobel

Prize winner I.R. Prigozhin). Sometimes self-protection or even thinking are called differentiating properties of living objects. However, not all living organisms have such properties (for instance, mushrooms or trees).

The extreme complexity is thought as an important difference of living objects from abiotic objects – in abiotic nature there are no objects that could be compared with living objects on their complexity. In the environment, under the influence of the flow of external (solar) energy, various abiotic objects of various degree complexity are formed spontaneously, but biotic objects never get formed. This fact was noticed long ago by Louis Pasteur, who formulated it as a law (living objects cannot be formed spontaneously in any flow of external energy) and the law is called Pasteur's Law. However, there are reasons to assume that as a stage of formation of life on the Earth, abiogenic synthesis of prebiotic substance had occurred in planet forming circumstellar disk (Autocatalysis concept), when comas of the substance for planet formation were initially formed as isolated non-linear waves in development of gravity instability in two-phase environment of the circumstellar disk, and some favourable conditions were formed in the comas for heterogenic catalytic synthesis of organic combinations that resulted in "the world of RNA". [135, 160, 161].

As opposed to abiotic objects, biotic objects exist as species of organisms with strictly determined dimension of bodies, all structures inside these are strictly correlated, while there is no correlation between the organisms themselves (the death of one organism does not affect the life of the other). In contradiction to this, internal structures of one organism seriously depend on each other (degradation of an internal structure – molecules or organelles in a cell or internal organs in pluricellular organisms – leads to serious consequences and even death of the organism). In abiotic nature the regulated processes – winds, oceanic flows and waves, atmospheric circulation are distributed in large territories and even cover the entire planet, but violation of such processes at a local area does not cause serious effects on the processes in other places.

Living objects exist only as populations (there are no such organisms that existed in a single copy), which in turn exist as interacting,

but not as correlated individuals (the death of one of such does not affect the population as a whole). In other words, life on the Earth is a combination of natural organisms (biota) that consists of discrete biological species (individuals of one species distinctly differ from individuals of closest species to them and there are no transition forms between them). In abiotic nature, it is possible that individual highly ordered objects are formed and that exist in single copies, for instance, a ball lightning, which disappears before the following similar lightning occurs.

Living objects go through natural selection, which results in establishment of new necessary qualities in populations. This is the capability to progressive evolution that is ensured owing to the presence of biological memory.

An important difference of living objects from abiotic objects is the tendency of all biological species to expansion that occurs everywhere. They occupy all the territories, where there are inflows of the substance and energy in sufficient quantities for their life activity. Expansion is specific to all biological species, including humans. Epidemics and pandemics are reasoned by the intention of microorganisms and viruses for expansion. When all territories are inhabited by living objects in the process of expansion, species start sustainable existence in such territories. This significantly differentiates expansion of living objects from blast-like distribution process of regulated objects of abiotic nature [50].

Biotic and abiotic objects form systems. The following are primarily classified as living systems:

- Systems with self-preservation structure and low level of information processing (level of unicellular and pluricellular organism, plants);
- Systems with relatively developed capability of receiving information, but that do not have self-conscious (level of animals);
- Systems with developed self-conscious, thinking, non-trivial behaviour (humans);
- Social systems and social organisations that include people and relationships between people.

The following are classified as abiotic systems:

- Systems with a stable structure that are not subjected to functional influences during long time periods (for instance, planets, mineral accumulations that are bedded in subsoil of such planets);
- Systems with a structure that periodically changes in time and they have several functions (for instance, geysers, rock formation processes, eruption of volcanoes).

2.2 EARTH IS THE ABSOLUTE VALUE OF LIFE

One of the major issues that the contemporary science has is associated with origin of life in the Universe and on the earth in particular. Life in the Universe was formed no earlier than formation of first stars for except for hydrogen and helium there were no other chemical elements of life – carbon oxygen and nitrogen. Life on earth in the Solar system may have been formed in the first very mystic 600 million years from initiation of its formation; otherwise, there would be a mechanism of transfer of large masses of biological compounds (the weight of dry biological substance on earth is no less than $2{,}5 \times 10^{18}$ gr on carbon) from one planet to another or from one star to another star, which is very problematic [160]. Life on earth was formed in a continuous process of self-organisation of matter from one stage to the following during its evolution as a result of abiogenic synthesis of primary pre-biological compounds that has resulted in "the RNA world" [161].

In its form on earth, life cannot exist on any planet. There are certain limitations on the weight of planets, their temperature regimes, age and form of the orbit.

Life may not develop on planets with very low or large weights for the first type planets would not be able to retain the atmosphere, which is required for life, while the heavy planets (at weights over 1/1000 solar weight) have very dense atmosphere that does not let solar rays through; and if a planet's weights exceed 1/20 of Sun's weight, some nuclear reactions would be initiated on it that would result in overheating of the planet to temperatures, upon which life would not be possible.

For carbon is the basis for life, the temperature interval of its existence will be determined by the interval of stability of organic molecules. The upper temperature limit is close to 120 °C. In 2006, the chemistry scientists from Munich Technical University C. Huber and G. Wachtershauser showed that some chemical reactions like carbon monoxide (CO) and hydrogen cyanide (HCN) may occur in hot volcanic sources and various organic molecules are formed including amine acids and simple lipids [79]. Hard substances that contain iron and nickel, already present in the hydrothermal waters serve the catalyser of these reactions. Reactions run especially well in the temperature range of 80-120 °C. The conditions of these experiments were maximally approximated to real conditions. According to the researchers, such conditions (including all components of the reaction mixture) could really exist in hydrothermal sources at early stages of development of the Earth. The main product of these reactions were alpha-hydroxide and alpha-amine acids. And as the temperature rose, the total output of final products increased, including the share of amine acids in relation to the hydroxide-acids. Some other organic substance were also produced in small amounts, including alpha-hydroxide-n-pentanoic acid and ethylene glycol. Presence of such molecules in the reaction products shows that abiogenic synthesis of lipids and sugars in hydrothermal source conditions is obviously realistic as synthesis of amine acids. As opposed to other known experiments on abiogenic synthesis of organic molecules, where there were no iron-nickel catalisers and "the striking" effects like electric charges were used, in artificially created conditions of hydrothermal sources, reactions run very selectively, regularly, with production of quite certain end products and without formation of "wastes" – inert hydrocarbon mixtures like tars or resins. The experiments of German scientists are a serious argument in favour of the hypothesis, according to which life could have been originated on earth in hydrothermal sources.

Water is the exclusive matter at all stages of development of life on the Earth, starting from its initiation. The prototype of organic substance exchange (absorption of nutrients, their reconstruction and production of metabolism products) is the exchange in inorganic environment that occurs with the help of water like in living organ-

isms. Owing to the high thermal capacity and low heat conductivity of water, the relative constancy of the World Ocean temperature is ensured (daily variation over the ocean surface do not exceed 1 °C, while annual variations – 10 °C. Ocean waters have very stable mineral salt contents, permanent concentration of hydrogen ions, constant osmotic pressure and mobility that ensures transfer and diversity of nutrients. Based on the constancy of the conditions and variety of nutrition sources, the World Ocean is an ideal environment for initiation and development of life.

The main chemical elements were formed in subsoil of stars. The Earth, its subsoil and all living and inorganic nature objects that exist on its surface consists of the same elements (Table 3)

Table 3

Element compositions of celestial and solar substance, plants and animals (*as per V.V. Rozen*)

Elements	Contents, %			
	Celestial substance	Solar substance	Plants	Animals
Hydrogen	81.76	87.0	10.0	10.0
Helium	18.17	12.9	-	-
Nitrogen	0.3	0.33	0.28	3.0
Carbon			0.3	18.0
Magnesium			0.8	0.05
Oxygen	0.03	0.25	79.0	65.0
Silicon	0.01	0.004	0.15	0.254
Sulphur				
Iron				
Other elements	0.001	0.04	7.49	3.696

Table 3 shows that the main objects of the Universe (stars, the Sun, plants and animals) are composed of the same atoms, while most distributed elements in the Universe – hydrogen, carbon nitrogen and oxygen – are also represented in living organisms in small amounts. This observed proximity of the chemical composition of the objects, separated by gigantic distances gives evidence for their chemical universality of living and inorganic objects.

For many years Mars was considered to be the probable habitat of extraterrestrial life in the Solar system, later Jupiter's satellite –

Europa was added to this. Under glacial surface of Europa, there may exist an ocean of the same temperature, cold and isolated like in the Vostok lake in the Antarctic. The temperature on the surface of Europa at its equator is – 160 °C, but under the glacier coat and under the influence of tidal forces of Jupiter, the temperature may be significantly higher. Existence of liquid water under the ice cover of Europa is quite probable. Live organisms may live here under the lower surface of the ice or float in the water stratum like the seaweeds or bacteria in the Arctic; they may gather around hydrothermal sources in the bottom of the ocean or even live under the ocean bottom.

Discovery of two potentially inhabited exoplanets of earth type has been confirmed. One of these – *Gliese 581d* – is located in 20 light-years from the Sun in the Libra and its weight is over 5 times the weight of the Earth. The other exoplanet – *HD 85512b* – is in 35 light-years from the Sun; it rotates around the orange dwarf in Canvas constellation. In case, if a planet has an atmosphere, similarly to the Earth with a greenhouse effect, then the near surface temperature would be 75 °C. The force of gravity on – *HD 85512b* – is 1.4 times more than that of the Earth, there is a high probability of existence of liquid water on it.

Contemporary concepts of origin, development and sense of life presume other chemical basics of existence of life that are different from those of the earth. In such theoretical structures carbon is replaced by silicon, water by ammonia, hydro-fluorine and even hydrocyanic acids. In extreme conditions of other Solar system planets, some very different branches of life may get developed that are quite different from those that we see in the Earth conditions.

Thus, the fundamental scientific research work allow us assume that the conditions that are unique for the Solar system, and possibly for our entire Galaxy, have been formed on the Earth for development of intellect/brain and implementation of diverse capabilities. The earth is not only the Cradle of Mankind. All its systems are the sources of maintaining life of Mankind. The probability of a chaotic (incidental, or merely evolutional) creation of a similar system with its long preservation in time is over minus with twenty degrees, which, from the point of formal logic, is absolutely impossible.

Therefore, the planet Earth must primarily be considered as an absolute value of life, and not an object of production impact. But this statement would be fair in relation to other planets (objects of the Universe), if they contain any forms of life, even primitive or even principally different forms than on Earth.

2.3 FORCES OF ABIOTIC NATURE AND ANTHROPOGENIC IMPACTS TO THE GEOLOGICAL SPHERES OF THE EARTH

The main laws of evolution of planets are established sufficiently well. A star is formed, when gravity leads to collapse of gas-dust particles of an inter-celestial cloud. About 5 billion years ago, very hot substances of a gas-dust cloud that had been formed around our Sun, started condensing into hard particles, which, in millions of years formed large bodies – about 10 km diameter planetisimales by hitting each other and sticking with each other. The process of growth of planetesimales continued until the time when only dozens or hundreds of bodies – "embryos of planets" were left in the internal part of the Solar system that weighed about 10% of modern planets. Collisions of largest bodies resulted in liberation of such amounts of energy that subsoil melted while iron and other heavy metals sank into depths forming the nucleus, while the less dense substances were concentrated at the surface. Differentiation into the nucleus and mantle and active volcanic processes resulted in formation of a hard core the composition of which differed from the mantle's composition.

During the following millions of years, huge collisions collisions (mega-impacts) of planet embryos continues by generating large amounts of energy melted large volumes of colliding large bodies, and small bodies were smashed on the surface of large bodies. This resulted in formation of four large planets with hard surfaces – Mercury, Venice, Earth and Mars, while at the periphery of the Solar system, far from the Solar heat, where the ice of water and methane, and carbon monoxide, ammonia and nitrogen could condense from protoplanetary nebula adding hard components of protoplanets – for gas giants – Jupiter, Saturn, Uranium and Neptune.

And if at early stages (until the limit of 3.5-3.9 billion years) the earth developed similarly like Mercury, Venice and Mars, in other words very slowly, but in geological time the evolution of its external region and earth crust is noted for unusual speed:

- 3.8 billion year ago water and photo-autotrophic living organisms were formed (prokaryotes – bacteria and cyano-bacteria);
2.8 billion years – the most ancient super-continent Vaalbara was destroyed;
- 2.3 billion years ago, oxygen atmosphere was formed; first cover glaciation as a result of green-house effect (when O_2/CO_2 ratio in the atmosphere of the planet moves towards oxygen, and the planet retains heat poorly);
- 1.9-2 billion years ago – eukaryotes were formed;
- 750 million years – ancient supercontinent Rodinia;
- 730-635 million years – second cover glaciation; formation of Gondvan mainland around the southern pole, which gradually drifted to the north;
- 620-600 million years – formation of many groups of pluricellular organisms; third cover glaciation;
- 542±0.3 million years – Cambrian paroxysm of biological life;
- 440 million years – Orodovician-Silurian mass extinction of biological species; 60% of sea invertebrates disappeared;
- 380 million years - formation of first vertebrate animals;
- 364 million years – Devonian extinction that lasted for 25 million years, which included from 8 to 10 extinction peaks; 50% of existing animal species;
- 360 million year – Gondvane – having joined with the north-Scandinavian mainland, formed Pangea supercontinent;
- 220 million years – last Pangea supercontinent was destroyed;
- 250 million years – Permian-Triace mass extinction of biological species; up to 90-95% of all animal types disappeared and 40-45% of plant types.
- 65 million years – Late Cretaceous mass extinction of biological species;
- 7 million years – formation of first hominids;
- 3.9 million years – formation of first Australopithecus;

- 200 thousand years – formation of Homo sapience representatives in East Africa.

There is only one continuous thing in evolution of our planet – that is constant changes. Upon its formation, it continuously changed under impacts of internal geological forces and external factors. The processes of formation, movement and destruction of tectonic shields, magmatism, volcanic activity, rock formation processes, earthquakes, other endogenic and exogenic processes that are closely associated with tectonic field processes, were very important in formation of the oceans of the Earth and continents, and life, which they feed. The reasons of mass extinction of species that was observed on the earth for many times, were caused by cosmic and geological factors, which the unilaterally specialised organisms could not adapt to:

- Rotation of the Solar system around the centre of the Galaxy that results in changes of the state of the space around the earth (flows of cosmic rays, magnetic fields, etc.), which had negative impact to biosphere;
- Powerful radiation cases, caused by blasts of super-new stars and causing catastrophic impact to biosphere;
- Splashes of Solar activity;
- Periodical approach and even collisions of the Earth with cosmic objects – comets, asteroids and declassed planets, etc.;
- Falling of large meteorites on the Earth that raised gigantic clouds of dust to the atmosphere and resulted in significant drops of temperature on the surface of the earth;
- Volcanic activity, rock formation processes, tectonic activity, movement of lithospheric shields that change climate and habitat of organisms;
- Change of the composition of the atmosphere due to volcanic activity following emission of large amounts of toxic gases and ash;
- Change of transparency of the atmosphere due to fall off asteroids, meteorites or due to volcanic activity;
- Variations of the level of the World Ocean;
- Damage of oceanic inversion- zone of upwelling and down-welling that change the climate, and together with ground water vol-

canic activity form large oxygen free zones that kill all organisms in the ocean;

- Catastrophic change of the nature of photoperiodism due to cosmic processes, which most earth organisms are not capable of adapting quickly.

In turn, biosphere had significant impact on the atmosphere and formation of other abiotic conditions on the planet like formation of the ozone layer, distribution of oxygen and formation of soils. Though humans cannot perceive it due to their relatively short life, this change is still going on and will be going on for the following several billion years. According to studies, in 200 million years Asia, America, Australia and Africa will join together into a new supercontinent. The epicentre of collision of the shields falls on Japan. Tokyo, and other large cities, located in other active tectonic zones – Tehran, Istanbul, San-Francisco will exist in conditions of constant threat of development of catastrophic geological processes.

During most of the geological time, humans did not influence the planet, because they simply did not exist, or because the number of its population was small. About 50 000 years ago, the Mankind experienced "the great jump" followed by such behavioural new things like creation of some sophisticated language of intercourse, living in caves, formation of first religious rituals, formation of arts and initiation of bargain trade.

Although there is no agreed opinion on the time and location of origin of these changes, but only few have doubt in the fact that these changes are closely associated with the start of use of minerals. People invented methods and means for mining of limestone, paints on the basis of iron and maintaining fire in the fireplace. Use of minerals significantly simplified the task of surviving and offered the humans all necessary things to lay the basics of civilisation. In addition, minerals continued giving means for production of useful things, thus giving more freedom, more options of choice of behaviour in everyday life. Out of the diversity of minerals*, eleven of such played important role

* In Russia an annual State Balance of Mineral Resources is prepared on the following minerals and components: abrasives, nitrogen, diamonds, asbestos, asbestos for special products, alphaltic pirobitumen and bitumen, barite and viterite, beryllium, bauxites, boric ores, brome, vanadium, vermiculite, bismuth, tungsten, flammable gases, gas condensate, gypsum and an-

in the history of human civilisation: silicon, iron, copper, gold, silver, coal, natural gas, oil, uranium, titanium and ground waters [26, 66].

They have both creative and destructive potentials. They facilitated not only the progress but extinction of people. They gave humans power to do good and evil, and they are capable of forming our future. Silicon, possibly, showed most influence on transformation of our society. Initially used as a raw material for making instruments of labour, jewellery, glass and mirrors, for the past fifty years as a semi-conductor, it became basis for making computers. In our computers era, any calculations and communications are effected actually without any effort, everybody has access to the information accumulated by humanity. Very brutal crimes were committed because of gold. Thousands of years this precious metal caused greed and cruelty in people, by making them rob, kill and enslave those who are also humans. Iron became a source of an almost hundred years of conflict between leading European powers, who fought for the possibility of controlling iron ore and coal deposits in Alsace and Lotharingia and in Ruhr basin.

World economy finds itself under heavy independence on mining and consumption of hydrocarbons. Oil gives power to the leaders, who control it. Sometimes, mining of oil may become a curse to larger extent than benefits for the countries, who mine it.

From industrial revolution days, burning of mineable fuel is resulting emissions of billions of tons of carbon dioxide into the atmosphere that causes change of climate of the Earth.

Possibly, the most destructive mineral turned to be uranium that

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hydrite, clays (bentonite, fire proof, hard melting, for drilling mud, helium, graphite, dolomite, iron ores, gold, flux limestone, emeralds, iodine, cadmium, stones (dust, natural, ornamental) construction stones, kaoline, carbonate material for chemical industry, quartz and quartzites, cobalt, lithium, magnesite and brusite, manganese ores, copper, chalk, mineral paints, molybdenum, vusvocite, arsenic, nepheline ores, oil, nickel, niobium and tantalum, ozokerite, tin, perlite material, fluorspar and fluorine, platinum group elements, cooking salt, ground waters, feldspar materials and vollastonite, piesooptic materials, dispersed elements, rare earth metals, mercury, lead, sulphur, silver, flammable gases, potassium salts, magnesium salts, glass quartz containing materials, strontium, sodium sulphate, talc, talc stone and pyrophyllite, heat-energy waters, peat, titanium, carbon dioxide, coal, uranium, flagopite, forming materials, phosphoritic ores, chrome ores, base metals, cement materials, zeolites, zinc, zircon, ethane, propane, butanes. Once in five years, a State Balance is prepared for the following minerals: high aluminous materials, carbonate materials for sugar and cellulose-paper industry, keramsite materials, siliceous materials, sand for concrete and silicate products, sand-gravel materials, materials for mineral wool.

has direct relation to one of the most grievous stories of human history – bombing of Hiroshima and Nagasaki in Japan. And the hopes for peaceful nuclear energy is now accompanied by the fear after Chernobyl Nuclear Station accident in 1986. By liberating its energy, humanity created the possibility for self-extinction.

Currently, geological industry of Mankind acts globally. People do not yet deal with the sphere of the Earth called the mantle, they have direct access to the Earth crust. But people annually move over 120 billion tons of rocks in construction and mining of minerals, which is four times over the mass of the material moved by the rivers of the Earth at washing off of continents. As a result of this activity, changes occur in the main planetary spheres of the Earth (Table 4).

Some statements have lately been made on the possibility that the impact of humans to the planet is leading to activation of endogenic and exogenic geological processes. In their report in 2011, the Intergovernmental Panel on Climate Change, (IPCC) indicated the possibility of geological reaction to climate change. According to the hypothesis of B. MacGuire, one of real dangers is that volcano eruptions, activation of tectonic and seismic processes, floods and landslides may occur even at slight impact to subsoil areas with accumulated stress. Though the average temperature on the earth has risen by 0.8 ^{o}C since 1900, there are already first and weak signs of the fact that warming is causing such processes.

Some growth of seismic activity in polar and near polar areas of the planet is noted. With melting of the strata of the Arctic and Antarctic ice, the some uplifting of the earth crust is occurring. Now Greenland is “floating up” at 2 cm per year. This huge territory yet keeps the low seismic activity owing to the ice that covers it. However, this balance may be broken for melting of the ice is accelerating and the load from the weight of the ice on the localised underneath tectonic faults is decreasing. Therefore, seismic activity may grow up. Such activity may happen anywhere, where active geological faults of the earth crust are yet compressed by large, but intensively melting ice masses in the Andes, Himalayas, and New Zealand South Alps.

Table 4

Impact of world mineral-raw complex to the main planetary spheres

Planetary spheres	Planetary sphere components	Main impacts
Lithosphere	Relief	Withdrawal of lands. Reforming of initial relief, including river and creek plains, especially in placer deposit mining, change and destruction of landscapes. Formation of waste rock dumps, mineral processing, washing of sandy, clayey-sandy, clayey-sandy-micaceous etc. sedimentation tails. Creation of man-caused (Moon) relief and landscape
	Subsoil	Extraction of rocks from subsoil. Destruction of soil cover. Creation of artificial cavities in subsoil. Use of subsoil for burying waste, including highly toxic and radioactive waste.
Atmosphere	Troposphere	Contamination with hard and gas substances (drill-blast works, dusting of waste dumps, self-inflammation of stockpiled rocks). Change of convective flows in the atmosphere over deep pits
Hydrosphere	Surface waters	Pumping of waters from shafts, pits and trenches. Swamping and flooding of territories. Change of orientation and mode of off-flows. Increasing of had substance flow. Contamination by waste waters.
	Ground waters	Change of levels of water horizons. Damage of hydrological regime. Exhaustion and contamination of ground waters.
Biosphere	Vegetation	Depression or even complete extinction of vegetation cover. Depauperisation of species composition.
	Animals	Damage to habitat. Extinction of food base.

The weight of additional water that reports into the oceans from melting ice increases the pressure on subduction zones under sea bot-

toms and, will possibly, stabilise the movements in such zones, and thus decrease the seismic activity and probability of tsunamis. On the other hand, the same effect (increase of the weight of the ocean waters and, consequently, pressure on the sea bottom) may cause displacement of epicentres of earthquakes to continents due to "unlocking" of faults at shorelines.

Though many tectonics specialists think that the climatic changes described by B. MacGuire would unlikely lead to catastrophic changes, nevertheless, it is known that during the last millennium the nature of seismic activity in the north of Europe and America is associated with so called glacial isostasy – post glacial uplifts of the earth crust. Similar processes are observed due to constant drop of the level of the Dead Sea at the rate of 0.88 m per year. Israeli geologists have established that dewatering of the Dead Sea due to increase of taking of water from the rivers that tribute to it is causing uplifting of the earth crust in the region at the velocity of 4.3mm a year*.

It's not the first time the geologists are discovering the interrelation of earthquakes with man-caused factors. So, the cause of the earthquake on May 11, 2011, near the Spanish town of Lorka, could have been the excessive water off take from ground water horizons, used by local farmers for irrigation of their lands**. This seismic activity was caused by a 20 centimetre shift of tectonic plates along a local fault. This shift occurred at an unexpectedly shallow depth – only in 3 kilometres from the surface. Such shallow depth partially explained disproportionally large damages that followed the 5,1 point magnitude earthquake. The scientists paid attention to the fact that the level of ground waters at the depression, at the boundary of which the shift had occurred, had dropped by 250 meters for the past 50 years. The local farmers had been pumping the water for irrigating their lands from deeper and deeper water drill holes and holes, often developed illegally.

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* Nof R., Ziv A, Doin M.-P. Rising of the lowest place on the Earth due to Dead Sea water-level drop: Evidence from SAR interferometry and GPS //Journal of Geophysical Research, Vol. 117, B 05412, 2012. 16 pp.

** Pablo J. González, Kristy F. Tiampo, Mimmo Palano, Flavio Cannavó & José Fernández. The 2011 Lorca earthquake slip distribution controlled by groundwater crustal unloading. Nature Geoscience 5, 821–825 (2012)

Large scale studies in 2015 by USA Geological Survey and Colorado University demonstrated confident interrelation between hydro-fracing and earthquakes.

In 1975-2008, no more than 6 earthquakes occurred per annum in Oklahoma (USA). In 2009, Oklahoma suffered 50 earthquakes, in 2010 this grew up to 1000. By 2015, this state was the second on seismic activity in the country, staying behind California only. Of course, most of the earthquakes in Oklahoma had below 2.5 points magnitude. Usually earthquakes over 4 points on Richter scale cause damage. The strongest earthquake in Oklahoma occurred in November 2011, its magnitude was 5.6 points and ruined 14 buildings and erections.

The specialists analysed the data on over 650 earthquakes in Oklahoma, Colorado, Texas and Arkansas, that occurred from 1970's to 2014, and established increase of the number of earthquakes to the end of this time interval: there is correlation between the rise of intensity and number of earthquakes and hydro-fracing – time of occurrence of earthquakes near the oil and gas mining areas often coincided with the use of intensive hydro-fracing.

In some countries (Bulgaria, the Netherlands, France, states Vermont and New-York in the USA) using of hydro-fracing in hydrocarbon mining is banned by law. In 2014 Great Britain cancelled the ban for mining of shale gas using the hydro-fracing method, introduced after two earthquakes in 2011 near Blackpool, caused by mining of shale gas. The government of SAR took a similar decision in September 2012.

Cases of increase of seismic activity due to man-caused impact in cases of flooding of large territories in construction of hydro-power stations and construction of geothermal systems have been recorded.

Consequences of exploitation and damage to inorganic nature is not perceived as a threat to the Mankind as seriously, as, for instance, a nuclear war, for, first of all, they are at a time distance from us, and secondly, mining of mineral resources and use of useful properties of subsoil create an illusion of activity "to the benefit" of population of the Earth. Nevertheless, man-caused changes of inorganic nature (changes and extinction of landscapes, reduction of mineral-raw material resources, damage to circulation modes and contamination of

ground waters, change of the structure of subsoil), the scales of which appear to be small in terms of the entire planet, may result in an accumulative effect of a no less destructive force, which in quite near future may be demonstrated in changes of the climate (at first stage – locally), destruction of ecosphere and reduction of territories, suitable for habitation of humans.

Nevertheless, the call for complete termination of use of mineral resources and "returning to the nature" will obviously be inadequate for such "decision" would be backed by complete refusal from such decision. An adequate decision requires readdressing the destiny of Mankind, it's relation to the inorganic nature and can only be taken based on morals. The decision lies in the space of ethical, and not a strategic sense, while all necessary decisions on change of strategies of human existence must be sought at practical discourse of the entire Mankind. [112].

However, this position causes many questions: how and to what extent the abiotic nature can be represented in similar discourses, if we are talking about its preservation, who and in what capacity can represent their interests? The answers can be obtained at parallelisation of thought of German Philosopher Karl-Otto Apel about the rights of animals. In his article "Ecological crisis as a problem of discourse ethics" [6] he, discussing the ways of out of the ecological crisis, suggested, primarily, reviewing traditional anthropocentrism, associated with subjective-objective paradigm of classical philosophy and strategic set up of brain. In anthropogenic ethics terms, humans are viewed as the only subject of teleology, while nature – in a best case – as an object of value-neutral description and causal explanation. However, the opposite position of overcoming the anthropological subjectivism that takes its origin from Shelling and implemented in the concept of "ontological biocentrism" ("deep ecology" of A. Naess [108]) does not overcome the methodological solipsism, which is general to both positions. Of course, here nature is viewed as a subject of evolution and, naturally, as something similar to humans that forms a general unity and finds its own telos in it. But the calls for "merging with nature", refusing from intellect and replacing it with empathy and feeling, feeling the responsibility with regard to the nature and consider

it as a living reality originate from this post-rationalistic position. In response to this position, K.O. Apel reminds us that this ecological crisis is not associated with nature, but, in general, does not impose any danger on it at least at the level of inorganic chemistry and microorganisms. The victim of human activities may be biosphere only and, primarily, human ecosphere itself. Plant and animal species, which have to die in this case, appear to be united with humans by some commonality of destiny. Care for salvation of nature causes association of it with the destiny of humans and consider evolution of nature as the proto-history of human history. According to K.O. Apel, the proposition on commonality of all creations of nature leads to the Buddhist "capitulation" before nature, when a complete ban is established to damage any living creature and it means the human guilt even in relation to killing of microorganisms for medical purposes. In this case, the proposition on differentiation of nature and its teleological structure is lost that has highest development in humans. The possibility of death of Mankind itself with preservation of nature as a whole is not perceived as more tragic from the point of view of equality of rights of all living creatures (for death and survival).

K.O. Apel thinks that the proposition on "the rights of animals" that are equal with human rights cannot hold water, because the rights assume obligations, mutual responsibility, which living creatures cannot take. They cannot file claims, which could be reasoned and defended in reasonable communications. As a "metaphor", the proposition on animal rights makes the reasonable solution more sophisticated than simpler. The philosopher thinks that ecological conscious would receive much more support if it originates from the perspective of the value of humans as the highest species of nature that can transcend. "*We must take into account the fact that in case of reconstruction of nature evolution as the proto-history of human history, in reality we do not deal with nature as a mere object of value-neutral that explains realisation/understanding of contemporary life sciences. Most probably, we deal with natural creatures as communication co-subjects, who are like or similar to humans*" [5].

The ethological and social-biological studies, in methodology of which one cannot ignore the quasi-hermeneutic heuristics that leads

to quasi-teleological perspective are the confirmation of appropriateness of treating animals as co-subjects. [5]. Acknowledgement of the commonality and analogy with living creatures does not give such the status of equal co-subjects ("*I think, this is simply prohibited due to the obligations that we have in front of humanity*"), but it intakes the conscious of the responsibility for nature and understanding about "the nature chart" as reconstruction of human proto-history into the anthropocentrism perspective. This position prohibits talking about and treating animals as "things". The main thing is that this position allows talking about quasi-rights of animals (correlate of legal rights) and about the possibility (and duty) for humans to be representatives and advocates of the interests of living creatures in practical discourses and institutions, established by humans. In this case, a possibility is made available for putting tasks in accordance with the idea of "deep ecology" of A. Naess on preservation of all surrounding nature and its landscape. In formulating this perspective, Apel talks about existence of "primordial" justified community" that represents interests of all living creatures. In strict terms however, representatives of human species only can be its members. Thus, "unlimited communicative community" that consists of all potentially interested parties, whose interests should, at least, be represented in an advocating way and taken into account, is applied to all living creatures.

If we follow the logic of K.O. Apel, we can say that "unlimited communicative community" that consists of all potentially interested parties, whose interests should be represented in advocating way and taken into account, is applied to all living creatures, and to the abiotic nature, i.e., to the geobiosociosystem – combined unity of four components: geological and geographic environments, biosphere and community. This very large conglomerate covers the entire planet as a single unity and is a combination of various parameters of the community, living and inorganic nature that are in close inextricable connection and involved in globalisation processes.

2.4 ESSENTIAL FEATURES OF MINERAL RESOURCES

To-date, the human civilisation needs in energy and materials

are satisfied due to use of several hundreds of minerals, starting from common minerals used in large amounts for production of construction materials and ending with rare chemical elements that are found in nature in very small quantities. Development of society is inevitably followed by search for new materials and technologies, add-up of the quantities of consumables produced by the industry, expansion of their assortment and improving of their quality. This tendency is supported by expansion of mineral mining and processing volumes, i.e., development of world economy is associated with continued growth of use of mineral resources (Table 5).

Table 5

Total world mineral resources production

(source: *BP Statistical Review of World Energy, June 2015; World Coal Institute, 2014; World Nonferrous Metal Statistics 1986-2005; GFMS Gold Survey, 2014*)

Years	Production					
	Natural gas (B CM)	Oil (M MT)	Coal, including brown (M MT Oil Equivalent	Uranium (MT)	Gold (kg)	Nickel (T MT)
1970	1021	2358.0	-	-	-	-
1980	1456	3092.0	2 805.0	-	-	-
1985	1676	2797.0	-	34,936	1,606,573	771.6
1990	2000	3175.0	2 677.0	49,728	2,149,276	894.5
1995	2141	3286.0	-	33,084	2,175,279	1030.4
2000	2436	3611.8	-	35,221	2,565,884	1223.8
2001	2493	3601.6	-	36,363	2,543,873	1284.0
2002	2524	3584.2	2 401.9	36,400	2,537,657	1303.1
2003	2620	3701.1	2 572.7	35,812	2,538,438	1349.5
2004	2711	3904.7	2 835.9	40,551	2,496,000	1355.0
2005	2789	3941.5	3018.2	41,827	2,550,000	1383.9
2006	2892	3961.2	3174.7	42,000	2,482,000	1397.0
2007	2968	3948.6	3311.2	40,000	2,476,000	1440.3
2008	3073	3988.6	3420.6	43,800	2,408,000	1484.9
2009	2989	3885.8	3412.7	50,800	2,589,000	1530.9
2010	3202	3975.4	3604.3	53,700	2,689,000	1590.4
2011	3316	4008.1	3869.4	53,500	2,694,000	1800.0
2012	3380	4116.4	3912.9	58,800	2,700,000	2100.0
2013	3409	4126.6	3961.4	59,600	-	-
2014	3461	4220.6	3933.5	61,000	-	-

A modern general diagram of consumption of mineral resources on the planet represents a picture that forms a different-pole structure of development of world economy, which has a "conglomerate" base of complex contradictions. They are determined by the uneven geographic positions that is specific to the Earth, including commercially mineable mineral resources for the modern level of economy, and uneven positioning of processing facilities, also irrational use by industrially developed and developing countries (Figure 3).

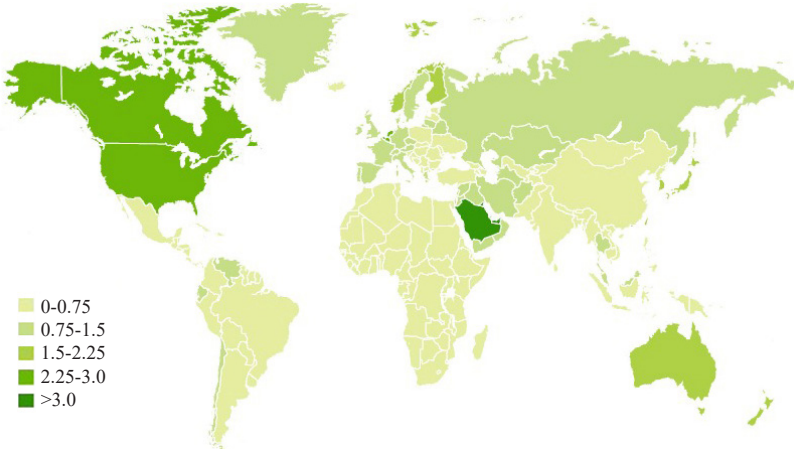

Figure 3. **Pro rata oil consumption for 2014 (tons)**
(*Data from BP Statistical Review of World Energy, June 2015*)

For the period of 1990-2014 the world mining rates of all mineral types increased significantly: oil by 1,9 tymes, gas by 1,5 times, iron ores by 3 times, copper by 2,3 times, nickel by 2,4 times, tin by 1,8 times, gold by 1,3 times, phosphates by 8,4 times, etc. Here, 14 countries own around 65 % of world oil resources (their total number of population makes 33 % of world population), and 6 countries own around 70 % of natural burning gas resources (total number population is 9 % of world population), 7 countries host around 78 % of coal resources (total number of population is 46 % of world population). Similar situation can be observed for other mineral types (Figure 4).

Examples of mining of a limited number of minerals bring to a conclusion that, in combination, in 2009, Russia, USA, Chi-

na, Great Britain, Germany, Italy, France and Japan consumed most amounts of the following minerals from world total volumes: oil 65 %, gas 73 %, coal 66 %, iron 67 %, aluminium 58 %, and nickel 67 %. USA, Japan, Germany etc. are leaders in pro rata consumption of mineral materials. For the past ten years, the share of developing countries in consumption of minerals has increased.

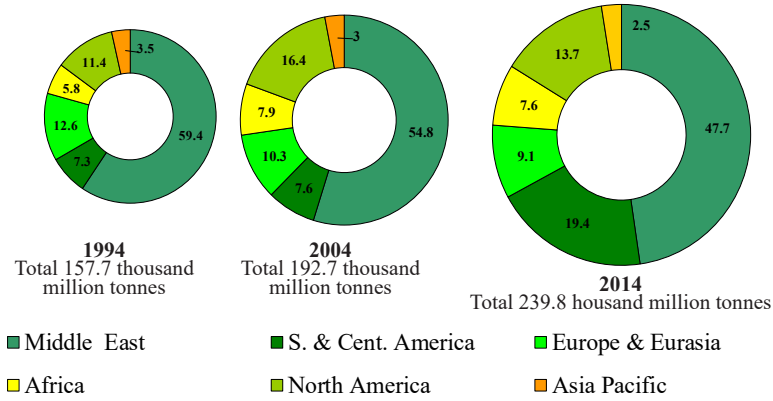

Figure 4. **Distribution of proven reserves of oil in 1994, 2004 and 2014** (*data from BP Statistical Review of World Energy, June 2015*)

While Russia, USA and China have possibilities of complete or partial satisfaction of their needs in minerals owing to in-house mining, the rest of the said countries are almost completely dependent on imports. According to this information, those industrially developed countries, who depend on mineral imports, developed systems of invariant mineral-raw material policies. For instance, in USA, while resources of many minerals are available in the country, the government has programs in place that envisage import of no less than 50% of required amounts. Economies of the said countries is oriented to processing of large amounts of different type imported mineral materials from various remote regions of the Earth. For the past few years, China has been developing a tendency of advanced import of stocks of those mineral types that are in deficit in the country – oil, iron ore, etc., for the purposes of creating some strategic reserve. Investments in minerals and not in US dollars and securities is the new trend in Chinese policy.

The level of geological knowledge achieved so far shows that in the process of evolution, some territories have been formed on the Earth that differ for hosting or lacking certain types of mineral resources that are commercially viable for mining. The results of extensive geological studies confirmed global natural unevenness of positioning of all types of minerals. According to the information obtained lately, on confirmed resources of a number of most consumed minerals the following is the ranking of countries in the world (according to the said succession):

- oil and gas condensate – Middle East countries (Saudi Arabia, Iraq, Kuwait, Iran, UAE) Russia, Venezuela, Mexico;
- natural gas – Russia, Iran, Qatar, Saudi Arabia, USA;
- coals – USA, China, Russia, SAR, Australia, Germany, India, Canada;
- uranium – Australia, Kazakhstan, SAR, Brazil, Namibia, Russia;
- iron – Russia, Ukraine, USA, Canada, Brazil, China, Kazakhstan;
- nickel – Cuba, Australia and Oceania, Canada, SAR, Indonesia, Greece;
- cobalt, Zaire, Cuba, Australia and Oceania, Zambia, Indonesia;
- aluminium – Guinea, Brazil, Australia, Jamaica, Cameroon, Mali;
- phosphates – Morocco, Kazakhstan, Russian, West Sahara, USA, Egypt, SAR, Australia, Algeria;
- potassium salts – Canada, Russia, Byelorussia, Germany, Turkmenistan [164].

Based on uneven geographic distribution in Earth's subsoil and volumes of consumption of mineral resources a consuming global industrial-man caused belt is defined (approximately between 40-60 °N – north of USA – south of Canada, middle parts of Europe, north of the Ukraine, south of Russia, Siberia along Trans-Siberian road, north of China, Japan), which concentrates world consumption of mineral resources and transport flows that serve them. Two global raw materials, energy sources, minerals and water source belts are located in the north and south. Raw material suppliers are both developed (Canada, SAR, Norway) and developing countries (Figure 5).

Figure 5. **Geography of Africa would look like this if each African country is renamed in accordance with the main export products.** (*Source: http://www.v8j.com/how-the-rest-of-the-world-sees-africa-in-the-name-of-democracy-999/)*

The unevenness of distribution and consumption of mineral resources, competition for access to such are the sources of global conflicts (see Chapter 3).

Mineral resources are limited and non-renewable resources of the planet. Growth of population and fast development of science-technical progress and industry have led to increase of consumption of mineral resources, aggravation of their deficit, and even occurrence of the threat of exhaustion of some types of minerals, especially of hydrocarbons. As per prognoses of the Ministry of Natural Resources and Ecology of RF, by 2022, Russia may face the threat of exhaustion

of commercially mineable resources of oil, and by 2025 – of gas.

Mineral deposits are formed in certain geological, geomorphological, physical-chemical conditions, combination of which may occur again very rarely or may not happen at all, in addition mineral deposit formation is a very long process in time, and the velocity may be dozens and hundreds of million years, which cannot be compared with the velocity of mining of mineral deposits.

So, 90% of known iron ore resources on the Earth are associated with unique Early Proterozoic Jaspelite formation of Krivoy Rog type. In the process of evolution of our planet this ore formation was formed once and simultaneously on all continents (in the interval of 2.4-2.2 billion years, i.e., for two hundred million years of geological history), by localising in morphologically similar and chronologically same age fissure-like faults of fluidogene type. And the process of completion of formation of this ore type was triggered by initial occurrence of thermally stable forms of free oxygen in the external spheres of the Earth [42]. Such unique combination of all formational conditions of Jaspelite formation is quite unlikely to occur again.

It is now over 50 years that the world community is concerned about the problem of exhaustion of mineral resources. The "Alarmists" (1960-1960) tried to prove that exhaustion of natural resources in the world would arrive within the following two-three decades. In their report to the Rome Club "Limits of growth", published in 1972, they presented the results of computer modelling of world civilisation development scenarios on the basis of five main parameters – number of population, amount of investments, amount of consumption of non-renewable resources, contamination of the environment and production of food [95-98].

In this work, D. Meadows and his co-authors did not claim the role of new prophets i.e., did not put an objective of foreseeing or strictly instructing something. They only expressed hope for the humanity to take preventive measures for limitation and regulation of growth and reorientation of its objectives, which would allow avoidance of overloading of the environment and getting out of the limits of self-sustainability of the Earth. However, they thought, the further we would ignore them, the more painful would the changes and the less

would the chance for final success be.

In their later works [95, 97, 98] the authors stated the fact of movement of humanity to a catastrophe due to exceeding of total load on the environment over the self-sustaining capability of the planet, global problems of climate changes, exhaustion of oil resources, degradation of agricultural lands, deficit of fresh water and extensive negligence of obvious consequences, forecasted by their computer models.

The opponents of the "alarmists" say that these forecasts did not come to truth, and currently some studies are underway to find a new model of using the resources of the earth. Their position is, partly, based on the assumption that there would be no exhaustion of mineral resources for as the deficit aggravates, the prices for such resources would rise. In turn, mineral price rise stimulates reproduction of resources: geologists would be looking and exploring low grade, more sophisticated, difficult to access and deeply bedded mineral deposits. At the same time, replacement of expensive deficit raw materials by cheap materials would be stimulated, new technologies that reduce consumption of non-renewable resources and expand use of non-traditional energy sources (solar, wind and sea tide) and raw materials (synthetic materials instead of asbestos, plastic and ceramics instead of metals), and use of secondary recycled materials would be implemented, which would reduce the load on the environment. In developed countries, profit taxes are gradually replaced by taxes on use of natural resources and on negative impact to the environment.

However, by the middle of XXI century these mechanisms may not be suitable to the reality. According to prognoses, due to high demographic growth, development and expansion of the list of human needs, by 2050 consumption of metals may increase by 5 times, use of recycled resources would, in best case, ensure the previous level of production, and mining of raw materials will have to be expanded, which would inevitably lead to damage of some natural complexes.

Exhaustion of mineral resources, their limited amounts and finiteness cause the question of accessibility, about rights for mineral resources not only those who currently live on the planet, but also of future generations. Governments of some countries have already

initiated formation of various reserve funds of mineral deposits. In Russia, such fund is established with deposits of strategic and deficit types of minerals, while in Kazakhstan – with deposits, mining of which is not commercially viable currently, or for minerals, for which there doesn't exist any processing and extraction technique. Such approach, consisting of simple conservation of mineral deposits is based on the assumption that the humanity will always live in a closed life system of the Earth and use only its resources. But we are already at the footsteps of turning this closed system into a dissipative system – "Earth-humans-Universe". On April 24th 2012, it was announced that a company called Planetary Resources Inc., was established, which was intended to undertake development of resources of asteroids. It is possible that the earthshaking effect of this project can be compared with launching of the first satellite of the earth. [162].

In addition, in physical conservation of mineral deposits, it is quite difficult to take into account the types of materials and technologies to be used by future generations. For instance, with invention and implementation of heap leaching technique in gold mining, over past 20 years saw most requirement for mineral deposits with large resources of low grade ores that contain fine gold, while for the entire XX century the high grade and coarse gold deposits had been very attractive. It is difficult to foresee the extent of the need for hydrocarbon resources by implementation for daily use of thermal-nuclear sources of energy or, so-called alternative energy sources that invert the energy of wind, tides and geothermal heat of the Earth etc., into electric energy.

Nevertheless, we can see that the problem of the rights of future generations for mineral materials has moved from theoretical field to that of practical implementation.

Thus, the essential properties of mineral resources are their deficiency (limitation), exhaustibility, non-renewability and their belonging not only to currently living but also to future generations.

2.5 GEOETHICAL PRINCIPLES AND GEOETHICAL IMPERATIVE

According to the history of civilisations on the Earth that flourished, decayed and died, we can see that in the ancient times people periodically tore up the foundations of their own life by their heedless aspiration to economic growth. However, current situation differs from ancient days by the fact that the "cause-and-effect" ratio that had been very simple and understandable, has changed radically. Today the entire world is overwhelmed by the "cause-and-effect" relations, which act independently on time and space. So, constant increase of extraction of fossil fuel from subsoil (coal, hydrocarbons, uranium) and burning it not only changes local landscapes, contaminates the environment, reduces the geodiversity at a certain subsoil area, but also increases the greenhouse effect and climatic changes in other regions. Usual principle of finding guilty people for such changes in globalisation conditions does not work.

In moral geoethics system the main element is represented by the principles that determine the strategy of moral behaviour and its unconditional moral orientation in its general terms. The principles were formulated in different years by different authors mostly for allied sciences (ecological ethics, global ethics) and later introduced into geoethics, but all of these are based on the essential properties of mineral resources – deficiency (limitation), exhaustibility, non-renewability and belonging not only to currently living but also to future generations:

- *the planet Earth is primarily considered to be the absolute value of life*, and not as an object of industrial impact [82];

- *principle of sympathy*: it is necessary to treat the problems of organic and inorganic nature from the point of view of "its interests" – normal existence of the natural, including geological environment, and humans, by avoiding egoistic or lucrative approaches [65, 102-104];

- *inter-relations principle*: no geosystems, planetary or local, do exist in isolines, and any change in any of these will inevitably lead to changes in another system of the same or higher level [31];

- *principles of harmony and balance of interests*: the necessity of liaising/harmonising interests of all social groups, related with use of mineral resources and useful properties of subsoil, by intruding into the geological environment, development of the mechanism of social accessibility of resources [65];

- *principle of geodiversity preservation* [64];

- *principle of responsibility in front of future generations and increasing variability*: any development should satisfy the needs of currently existing generation without any threat to the needs of other generations, and any taken decision for implementation of geoethical situations, dilemmas and problems should increase the possibilities/opportunities of currently living and future generations, and not degradation of such [31];

- *principle of forecasting*: analysis of possible changes should take into account not only the velocity of the processes of development of human civilisation, but also the velocity of the processes of geological evolution [31];

- *precautionary principle*: any threat from any possible danger of natural, including geological, catastrophes upon taking management decisions should be taken into account as a really existing danger, even if such risk is of a preliminary scientific hypothetic nature [114, 116].

- *principle of reversibility*: the changes in geosystems of all levels, in the process of their performance must leave a possibility for taking a different geoethical decision in case of occurrence of unforeseen consequences [31];

- *principle of integration*: the norms of ethical approach to inorganic nature should be introduced in laws, standards and rules of conduct of nations of the world.

For comparison purposes, we shall demonstrate the main principles of ecological ethics that are established in the Rio-de-Janeiro Declaration on Environment and Development (Rio Declaration) signed in 1992 at a UNO conference:

- *principle of respect to all life forms*, that affirms the value of each living creature: “any form of life should be respected irrespective of its usefulness for humans”, “each organism, whether human or else, whether it has a capability of feeling or not, safe for humans or not, is

a values itself" («Environmental Ethics. Policy document». P. 7);

- *biodiversity principle*, that affirms the value of biodiversity and necessity in its preservation;

- *principle of maintaining sustainability of biosphere* that is the basics of sustainable development;

- *principle of ecological justice* states equal distribution of the rights for ecological safety between humans; and everybody is imposed responsibility for its preservations;

- *precautionary principle*, according to which, it is necessary to primarily take into account most dangerous possible development of events while developing a policy that directly or indirectly impacts to ecology;

- *principle of general ownership to natural resources* expresses the understanding of the Earth as an integral unity; according to this principle, people carry equal responsibility for natural resources.

In 1980's in the process of establishment of ecological ethics and ecological ideology, similarly to E. Kant's categorical imperative N.N. Moiseev introduced the term "ecological imperative" [104]. The scientific circles immediately started discussions that are still ongoing, about valuable-normative bases of the ecological imperative and fields of its application. Despite wide use of this term, its content is not yet fully developed. Its use often occurs in the context of general calls of ecological alarmists ("do not cause damage to the nature") and does not carry any moral-ethical content. N.N. Moiseev defined it as "a system of limitations, violation of which may cause irreversible consequences for further existence of humanity and the entire surrounding world" [104].

In 2005, N.P. Grigoryev introduced *the principle of moderateness* (*the principle of "do not damage"*) in geoethics based on the ecological imperative: actions in relation to geological objects and geological systems of any level should by all means avoid causing damage [65]. However, this direct borrowing from a discipline that is "allied" to geoethics is still within "alarmism" ideas.

In the context of the relations that we are studying in the "human-abiotic nature" system, one species of living creatures overtakes the adherence to the rules of ethical study and use of mineral resourc-

es and useful properties of subsoil, therefore, it is necessary to introduce a notion of geoethical imperative: sustainable development in the threefold system of "*abiotic nature-humans-society" should be based on the necessity of ensuring*:

- *Human rights for healthy and productive life in harmony with the nature,*
- *Equality of possibilities of development and preservation of abiotic nature, including mineral resources, useful properties of subsoil, landscapes etc., for current and future generations,*
- *Social-economic development, oriented for improvement of the quality of life of people in admissible limits of economic capacity of geological systems and objects,*
- *Elimination of the causes of negative impacts, and not the consequences, to geological objects and geological systems of other levels,*
- *Formation of geoethical conscious and world view of humans, a geoethical system of upbringing and education.*

These requirements that basically express the essence of geoethical imperative, demonstrate inextricable and organic interconnection of objectives of preservation of geological objects and geological systems, and social and economic purposes of sustainable development at the level of understanding, which modern society is prepared to accept. The notion of geoethical imperative is a dynamic process. It's filling and content may vary in time subject to achievement of the established targets, and transformations are possible from preferences of economic targets to preferences of social purposes and purposes of preservation of geological objects, geological systems and geodiversity in maximum possible extent.

Thus, the category of "geoethical imperative" is objective, and does not depend on the wishes and desires of an individual person, and is determined by correlation of the properties of inorganic nature, physiological and social peculiarities of entire species. Consequently, geoethical imperative represents a fundamental component of sustainable development of the three-fold system of "abiotic nature-humans-society"; in axiological thinking, it is a substantial reality that has been originated and is developing in the process of global

sociogenesis and geological evolution of the Earth. It exists within the boundaries of the latter and determined by correlation of the properties of the geological environment and peculiarities of civilisations and cultures. And if Kant's imperative, being the basics of survival in its essence, allows regulation of relations between people inside a society, geoethical imperative is intended to regulate interrelationships between people and abiotic nature.

A Buddhist proverb says: "Each human being is given a key from the gates of paradise, but the same key opens the gates to hell". We can throw away the keys and lose the possibility of entering through the gates of paradise here on Earth for good. But we cannot deny the value of these keys. And we are capable of resolving the task on the basis of geoethical principles – as how and in what conditions we better use to maximise the distance of exhaustion of non-renewable resources, rationally and fairly dispose of the wastes of their exploitation by preserving the bio- and geo-diversity of our planet and Solar system planets and exclude the risks of suffering and death of people from geological catastrophes.

CHAPTER 3

MINERAL RESOURCES AS A ROOT CAUSE OF GLOBAL AND LOCAL CONFLICTS IN THE MODERN WORLD

3.1 NON-RENEWABLE RESOURCES WARS

Natural resources are components of natural environment used to satisfy material and nonmaterial (cultural, informational and so on) human needs and which can bring profit. Due to their ability to recover after being extracted for further usage natural resources are divided into renewable and nonrenewable.

Renewable resources are natural resources able to recover after

partial withdrawal for consumption purposes. To them refer: living organisms' populations able to reproduce themselves and regain their head count, forest resources, nonforest vegetation resources and biological resources. Besides, some abiogenic resources can be naturally refilled, for example, water resources which are not isolated from planetary circulation. Renewability of such natural resources category is rather relative, depends on their usage intensity and is possible only if extraction rate within growth and refilling is maintained. In case of excessive usage (overfishing, over-cutting of forests) populations can peter out till extinction.

Nonrenewable resources are natural resources not able to renew and refill themselves. These are mainly subsoil resources: mineral resources including ground water, underground space, geothermal energy and others. In subsurface resources while being extracted substance is finite as within a historic as it seems to a person period of time circuit is not accomplished. Ground water turns over in a period from one year to one hundred and even one thousand years. Geological conditions for formation of mineral resources deposits are unique and for most types of mineral resources they didn't occur again during the evolution of our planet.

Land resources such as soil (basis for producing plant-growing and cattle breeding products) are renewable, but as space for construction are finite (nonrenewable). Land resources on the planet which are potentially good for agriculture make 2-4 bln. ha (13-27 % of terrain); there are reserves in the South America, Africa, Australia and partially in Asia; 2.6 mln. ha are meadows and pastures. About 1.5 bln. ha. are cultivated. Annually the square of land pieces useful for agriculture is decreasing due to soil erosion advancing, salinification, desert advancing and urbanization of new land reclaiming speed.

There is 0.28 ha per head of population. Out of 117 developing countries in Africa, Asia and Latin America 19 (104 mln. people) will not be able to feed their population even having maximum possible harvests [50].

Oil resources (17.5 bln. t) and gas, up to 80-90 %, are concentrated in several dozens of world countries, mainly in the zone of the Persian Gulf (62 %) – Saudi Arabia (26 %), Kuwait, Qatar, Iran, Iraq,

and in the Carribean (in Venezuela – 7 %), also in Russia and the USA (oil shale deposits).

Proven reserves of all types coal account for 1.569 trillion tons of equivalent fuel. The biggest reserves belong to the USA, China, Australia, Germany, Russia, Canada, Great Britain and the republic of South Africa.

World iron ore reserves account for 302 bln. t. Main deposits are located in Russia, the Ukraine, Brazil, China, Korea, and Australia.

Manganese (21 bln. t of ore containing 16-50 % of manganese) is mostly found in Equatorial Africa. 63 % of bauxite proven reserves (26.8 bln. t) are concentrated in Guinea, Australia, Brazil, Vietnam, India and Indonesia.

Proven world reserves of copper amount to 668 bln. tons. Their main part is concentrated in the USA, Chile, Peru, Canada, Indonesia and Uzbekistan.

There are only 5.071 bln. tons of phosphates including 4.4 bln. tons of rock phosphates. The leaders are Morocco (35.5 % of reserves), Brazil, Egypt, Western Sahara, Kazakhstan and Russia.

The uneven distribution and consumption of mineral resources are the main source of global and local conflicts. Throughout the history of human civilization the vast majority of wars, whether we take the Pelopponesian war or the US invasion of Iraq and the seizure of Libya after the killing of Muammar Kaddafi, was fought for resources: land, gold, silver, coal, oil, gas, surface and ground water.

Present-day conflicts in Iraq, Nigeria, Syria, the Ukraine, the South Sudan, waters of the East China and the South China seas are due not only to pre-existing historical conflicts between neighboring tribes, nations and religious groups but also due to aspiration to control oil and gas assets, which actually mean the control over main resources of sources of national income resource economies. The control over deposits is converted into geopolitical influence of some and economical vulnerability for others. Often the profit from selling of oil, diamonds and gold are used by terrorists for local wars.

The Islamic State of Iraq and the Levant (ISIL) is a terrorist organization operating on the territory of Iraq and Syria, and aiming to establish Islamic Caliphate in controlled by them regions. It keeps

under its control main oil-producing regions of Syria and oil refining facilities in Iraq. Though the level of production on the captured deposits has fallen significantly*, extracted and sold via various secret channels oil is enough to supply terrorists with revenue and working capital to buy weapons and military equipment.

Nigeria ranks first in Africa in oil production volumes (about 2.36 mln. barrels per day in 2014). Terrorist group "Boko Haram», since March 2015 calling itself "West African province of Islamic State», sets its ultimate goal to implement Shari Law on the whole Nigeria territory and eradication of the Western lifestyle. And while most of Nigerians condemn its violent and cruel methods, including kidnapping of hundreds of teenage girls from public schools, these organizations are nourished by discontent and resentment of many Nigerians living on two dollars a day, mired in corruption government and withdrawal of most of oil revenues abroad. In February 2012 the Governor of the Central Bank Lamido Sanusi said to parliamentary Commission of Inquiry that state corporation Petroleum Corporation had not transferred approximately 20 mln dollars of proceeds received from the sale of oil to the Treasury, though it was required by country's legislation. The money went to accounts of private individuals [88].

One of the reasons of the conflict in the South Sudan is also raw hydrocarbons. Oil is the main country resource, on which rests the whole South Sudan economy. In 2013 its production made 4.9 mln. tons (99 thousands of barrels per day). In fact the creation of the South Sudan was the result of politics in the sphere of oil production. Civil war in Sudan lasted from 1955 till 1972 and finished only when the government of Muslim majority on the North agreed to grant more autonomy to peoples of the southern part of the country, who mostly profess traditional African beliefs of Christianity. But when they found oil in the South management of the North Sudan retracted its earlier promises and tried to take control over the oil fields. That provoked the second civil war which lasted from 1983 till 2005. Approximately two million people died during that war. As a result the South received fill autonomy and the right to vote on the issue of separation. After the referendum in January 2011 where 98.8 % of Southerners voted for

* Pre-war production in Syria in captured regions accounted to 400 k barrels per day [88]

separation the country became independent on July of the same year.

In a short time after the new state was born conflict because of oil restarted on the North. Though the South Sudan has got enough oil the only pipe providing the opportunity for its export runs to the Red sea coast through the North Sudan. That is why the South for sure depends on the North relative to income of the state. Outraged by the loss of the deposits the Northerners appointed extremely high price for oil transportation that led to shutdowns of oil deliveries by the South and periodic outbreaks of violence at still disputed by two countries borders. Finally in August 2012 the countries agreed on the formula of oil wealth sharing, and pumping of oil was resumed. However in some controlled by the North but occupied by connected with the South people places borders battle actions are still going on.

Now then the South Sudan has again guaranteed itself earnings from export of oil, its president Salva Kiir is seeking to strengthen his control over the country and get all oil earnings. Stating that they prepared a coup against him under the leadership of authorities opponents, who were lead supposedly by vice-president Riek Machar. On July, 24, 2013 he disbanded his multinational government and started to arrest allies of Machar. As a result fighting for power quickly grew into ethnic civil war and people from president Kiir's nation – Dinka – are fighting against representatives of the Nuer, to whom Machar belongs. Despite several attempts to agree on ceasefire, fighting is still going on since December. Fights have taken thousands of human lives, and hundreds thousands of South Sudan people had to leave their houses.

The fighting in the South Sudan, as in Syria and Iraq, mainly takes place close to important oil deposits. Both sides are determined to take them under control and get the earnings from them. As of March the deposit Paloch which is under control of the governmental army in Upper Nile state gave about 150 thousand barrels per day giving the state and the companies involved in oil production about 15 million dollars earning. Rebel forces are trying to seize these fields to deprive the state of earnings [88].

Armed ethnic conflict between Dinka and Nuer which has been on since 2013 and low oil prices are stifling oil production industry

of the South Sudan. In particular, according to Jhonathan Markham, GlobalData Upstream Oil&Gas analyst, in в 2013 году, before the conflict had started, the production in the South Sudan was about 240 thousand barrels per day, and by now has dropped down to 165 thousand barrels per day.

Neither the government nor the rebel forces can't take control over the key oil regions. As a result the infrastructure is damaged and this has already thrown the country at least 7 years back, and the production will not be able to return to the same level till 2020. Furthermore, despite proven reserves of 3.5 bln barrels and the potential for further prospecting, oil companies are not ready to make investments until the stabilization of the situation in the South Sudan.

On the basis of 60-65 dollars per barrel price, the South Sudan earns about $ 100 million per month from oil exports that is approximately 90 % of government revenues. However, most likely, at the end of 2015 oil production will fall even more due to the recent escalation of the conflict near the oil fields.

The authorities would not want to rely only on two existing oil-pipelines that run through Sudan, they explore the possibility of building new ones – in Uganda and Kenya. However, these plans in connection with the smoldering conflict went no further than a technical and economical study.

In the East China and South China seas, China and its neighbors claim to numerous atolls and Islands located on the vast marine oil and gas fields. In recent years there were repeatedly collisions of the Navy in the waters of these seas.

About one third of the total production of oil and gas resources of China is produced in the South China sea. Scientists estimate that the oil reserves in the South China Sea range from 23 to 30 billion tons, natural gas that is about 16 trillion cubic meters. About 70 % of their volume is located in the deep offshore. A shelf and a group of Islands in the South China Sea have long been the subject of a territorial dispute between the States of the region – China, Vietnam, Malaysia, Brunei, the Philippines, and Taiwan.

Tensions peaked in May 2014, when the Chinese were placed in waters that Vietnam claimed as the exclusive economic zone, its

largest deep-water drilling installation of HD-981 offshore oil company CNOOC. Arriving in the area of drilling operations, located approximately 120 nautical miles off the coast of Vietnam, the Chinese surrounded the HD-981 with the fleet of ships of the Navy and coast guard. When the Vietnamese boarder ships attempted to penetrate that defensive ring in an attempt to direct it to the side the Chinese seamen began to ram them and water from the water cannon. There were no human losses during these clashes, however in Vietnam anti-Chinese disturbances began in response to those sea encroachments.

Starting May, 13 More than 15 thousand Vietnamese workers began series of large-scale protests against the activities of China in the South China Sea. Demonstrations were held throughout Vietnam, where the majority of enterprises with participation of Chinese capital were concentrated. According to Chinese media, the rioters also damaged the property of companies belonging to citizens of Taiwan, Singapore, South Korea and Japan. In those disorders mainly Taiwanese company were affected. The greatest damage was made to the steel plant, located in the Vietnamese province of Hatin and owned by the Taiwanese company Formosa plastics group (Formosa Plastics Group). The riots began with a strike of Vietnamese workers, which quickly turned into pogroms. The strikers beat Taiwanese employees, ruined the administration office and damaged equipment. As a result one Chinese person died and about 150 were wounded. Pogroms caused panic among the Chinese living in Vietnam, resulting in hundreds of Chinese citizens urgently leaving the country. 1000 Taiwanese companies operated in the Vietnamese province of Binziong, 200 of which were attacked, 11 were looted.

The cause of riots and clashes over the deployment of HD-981 was not only nationalism and resentment over past humiliations. China National Offshore Oil Company which owns the Installing HD-981 is conducting extensive seismic testing in the disputed area for the purpose of exploration of hydrocarbon deposits.

Consuming more than all the world energy, China is desperately trying to get access to new sources of fossil fuel wherever it can. To meet the growing energy needs of the country, the Chinese government is ready to buy African, Russian and middle Eastern oil and gas

in various large quantities, and even oil shale deposits in the United States which became in 2015 marginally low profitable. But it is quiet natural that it prefers to develop and operate its own deposits. For it the South China Sea is not foreign, but the Chinese source of energy, and it is determined to maintain control over it by all necessary means. And because other countries, including Vietnam and the Philippines, also want to exploit these oil and gas fields, further and more violent collisions seem almost inevitable.

By now hydrocarbon raw material is the most valuable natural resources in the world. It not only forms a major source of revenue for States and corporations that control its production and delivery to consumers, control over oil and gas is converted into geo-political influence of some and economic vulnerability for others.

In XXI century underground water became as precious as oil and gas, especially if they were suitable for drinking. Though more than two thirds of our planet's surface is covered with water, 97 % of it is salt water, 3 % is fresh water (13 58 768 000 km^3), including 1 % suitable for drinking and 2 % trapped in glaciers and ice. Nature managed this in such a way that the amount of water on the planet is fixed and the population is constantly growing.

The UN experts called water crisis one of the most acute problems of the near future, and the period between 2005 and 2015 was declared the international decade for action "Water for life", encouraging public and private developments to assist the countries lacking fresh water.

All this time scientists have been studying the structure of water usage in different countries, from household to production needs. According to data received fresh water consumption increased significantly. First of all water is supplied to support agricultural lands and production plants, though nowadays people drink more and pour more water on themselves. Each person needs from 30 to 50 liters of water for drinking, cooking and personal hygiene daily. However more than 40 % world's population - about 2.5 billion – lives in regions experiencing mild or severe lack of water. It is expected that by 2025 the number will grow up to 5.5 billion, 2/3 of planet's inhabitants.

The main factors affecting the rapid disappearance of water, suit-

able for drinking and domestic water supply, experts call three: global climate change, wasteful consumption of resource and the powerful growth of the world population.

According to forecasts, by 2030 due to climate change, population growth, urbanization and environmental pollution demand for fresh water will exceed supply by 40 % [32].

Prior to the invasion in Iraq in 2003, CIA analysts reported on a prediction of wars aimed to establish control over water resources – “hydrological wars». Unfortunately these predictions are becoming real, beginning with recent wars in Iraq, Libya and Syria.

Libya is located on the territory with distribution of resource not less valuable than oil. This is the Nubian aquifer, also known as the Savornin Sea, which is the largest of the world's known sources of fresh groundwater. It is localized in the depths of the Eastern part of the Sahara desert on an area of just over two million square kilometers and encompasses the boundaries of four countries in northeast Africa, including North-Western Sudan, North-Eastern Chad, South-East of Libya and most of Egypt. Containing about 150 thousand km^3 of groundwater of the Nubian aquifer is of great importance for the water scarcity in these countries.

From 1984 to 2007 in Libya when Gaddafi ruled the country the most ambitious irrigation project in the history of mankind called “Great man-made river” was implemented, which was a system of more than 1,300 wells to a depth of over 500 meters, the network of water conduits that supplied the desert regions and the coast of Libya with water from the Nubian aquifer, supplying 6 500 000 m^3 of drinking water per day. Muammar Gaddafi has called the river the “Eighth wonder of the world". The cost of construction amounted to $ 25 billion. These were funds of the state budget of Libya.

At the time of NATO-led war against Libya in 2011, three phases of the Great Man-Made River were already finished. The first and largest phase, providing two million cubic meters of water a day along 1,200 km pipeline to Benghazi and Sirte, was formally inaugurated in August. The second phase included the delivery of 1 million cubic meters of water a day to the western part of coastal belt and also Tripoli. The third phase provided the planned expansion of the existing

Phase I and supplied Tobruk and the coast from a new wellfield.

In July 2011 NATO not only bombed the Great Man-Made River water supply pipeline near Brega, but also destroyed the factory that produced the pipes to repair it. to "justify" itself NATO claimed, that the River was used as a "military storage facility" and that "rockets were launched from there». Six of the facility's security guards were killed. The water supply for the 70 % of the population who depended on the piped supply for personal use and for irrigation was compromised Actually Libya's vital infrastructure was damaged.

In the beginning of the construction Mr.Gaddafi characterized the "Great Man-Made River" project as a developed one for Libyans, built by Libyans and for the benefit of the Libyan population in order to turn a country that is 95 % desert into an arable oasis and also for free supply of drinkable water for each Libyan inhabitant in need. And now major French transnational corporations Suez Environnement S.A., Ondeo and Saur which control almost half of the world's $400 billion water market redirect "Great River" revenues to French contractors and shareholders, supplying fresh water to Libyans at higher prices [32].

The most recent case of "hydrologic war" is the war in Syria. Israel was leading a Western campaign to support Syrian rebels. In part, because its leaders asserted that the Syrian President, Bashar Al-Assad poses an existential threat to Israel on the issue of water resources, as he promised to reclaim the Golan Heights – a strip of land that Israel captured from Syria in the Six Day War of 1967. At present more that 40 % of Israel fresh water comes from the sources running through the territory of the Golan Heights and their reclaiming will definitely bring Israel to water deficit and ecological catastrophe [32].

With each year more and more attention is attracted by the Arctic shelf. Supposedly there are 30 % of undiscovered natural gas and 13 % oil deposits under the Arctic ice. The total amount of natural gas reserves in the Russian Arctic shelf is 57.1 trillion cubic meters or 32.2 % of the Russian reserves. On the shelf of the Barents and Pechora seas deposits of gas were revealed (Ledovoye, Ludlovskoe, Murmansk, Shtokman – 68% of proven reserves in the Russian shelf, oil (Prirazlomnoye – 65 million tons). On the Kara sea shelf gas fields are

identified (Leningradskoye and Rusanovskoye), oil (Salekaptskoye, Yurkharovskoye) and six gas fields that are located partially within the limits of the continental shelf and partly on land. Arctic mineral resources of the United States are oil (Alaska is one-fifth of the oil resources of the United States) and gas (Kuparuk). By now mining in this region is extremely costly. But the melting of the ice is gradually making the development of mineral resources in the Arctic more accessible.

According to the Declaration on the protection of the environment (1991), Declaration on the establishment of the Arctic Council (1996) and Iqaluit Declaration of States of the Arctic Council Ministers, the Arctic includes five countries, which face the coast of the Arctic ocean (Russia, Canada, USA, Norway, Denmark), plus Iceland, Finland and Sweden. To the Arctic zone of these countries you can refer part of the land and marine space in the Arctic ocean which is under the jurisdiction of the: the United States (Alaska, north to 60º north latitude, The Chukchi and the Bering sea, the Beaufort Sea), Canada (Yukon, Northwest Territories, north of 60° north latitude, the Islands of the Queen Elizabeth, the Beaufort Sea, the Baffin Bay), Denmark (the Island of Greenland, the Lincoln Sea, the Baffin Bay, the Labrador Sea, the Greenland sea, the Devisov Strait, the Denmark Strait), Norway (the Norwegian Sea, north to 62° north latitude, the Barents sea, the Spitsbergen).

To the wealth of the Arctic can be referred not only minerals, but also the transport routes. Currently, the shipping route along the Northern coasts of Russia is difficult to consider as a rival to routes through the Panama and Suez canals, though they are much longer. But climate changes make the Northern sea route more navigable. Meanwhile, legal issues related to the region, are still not settled. How to take into account the interests of extra-regional states in the Arctic, without legitimating rights of the countries of the Arctic five (the USA, Russia, Norway, Canada and Denmark)?

For decades the Arctic has been, without exaggeration, the world's only closed from other extra-regional countries in the area of the World ocean. The implementation of their marine activities was restricted by severe climatic conditions and the water area covered

with ice. And military-political confrontation of the Cold war forced the Arctic states to give priority to the control over the region.

The situation started to change with the acception of the III UN Conference on April, 30, 1982 the United Nations Convention on the Law of the Sea (UNCLOS). This Convention is usually called “Constitution for oceans». It consists of 320 articles, 9 appendixes and covers almost all questions of marine space and its usage, including navigation and overflight, exploration and development of resources, protection of the marine environment from pollution, fishing and shipping. The Convention regulates the conduct of states in the oceans, defining marine zones, stating rules for the delimitation of marine boundaries, rights, obligations and responsibility of states, and establishes a dispute settlement mechanism.

Extra-regional countries were interested in the application of its rules and regulations to the Arctic Ocean: she gave them rights to exercise certain economic activities in the areas of sovereignty and areas of jurisdiction of the Arctic States. Incipient hysteria on global warming opened even greater possibilities to them. In the future they would be able to access the development of spaces and resources liberated from ice of the Central Arctic, which by its legal status in the framework of the Convention could be considered as an area of open sea with all its attendant freedoms.

Having ratified in 1997 the above mentioned Convention, Russia took a course on the use of its rules and regulations in relation to the Arctic. The start to the battle for the Arctic had been given, when our country became the first one out of the Arctic five to file the official presentation to the Commission on the limits of the continental shelf to determine the external (legal) limits of its continental shelf in 2001. Other Arctic States were faced with the need to act accordingly so as not to lose the beginning of “Arctic race” and the installation of the Russian flag on the bottom of the Arctic ocean brought out of hibernation even the US, long considered the Arctic as a peripheral region of its foreign policy. The Russian application not only changed the prevailing status quo in the Arctic, but also deprived the Arctic countries of the possibility to discuss models of management of this marine region. Russia's use of Article 76 of the Convention about the

conduct of the demarcation line between the continental shelf and the International seabed area resulted in the possibility of internationalization of the Central part of the Arctic in the interests of the majority of the world community. So, the resources of the seabed and subsoil of the continental shelf beyond the conventional limits of 350 nautical miles from the baselines or 100 nautical miles from the 2,500th isobath (a line connecting the depth of 2,500 meters) – got the status of "common heritage of mankind" and were placed under the control of the International seabed authority.

It is not surprising that the most ardent supporters of the regime of the Convention, opening the door to the Arctic, are such supranational structures like the EU and NATO; the world's largest economies – Japan and China; the Asian tigers – Singapore and South Korea. Landlocked Mongolia is eager to grab a piece of the Arctic pie by getting the observer status in the Arctic Council, all this - under flags of "convenience", part of which is the merchant fleet, and Turkey which did not ratified the Convention, as well as a number of developing Latin American countries.

The main question today is does all this match the interests of the Arctic five; whether they have any possibilities to form management regime in Arctic, aimed at priority accounting of their national interests; if, finally, the Convention is the only regulator in relation to this marine region?

In recent years some steps have been taken witnessing that initially uncompromising attitude to the necessity of application of the Convention to the Arctic is being replaced by the realization that it is just one of the sources of international law. In the Ilulissat Declaration of 2008, it was stated deliberately that to the Arctic "extensive international legal framework" is applied, without specific mentioning of the 1982 Convention. Increasingly they began to recall that the application of the provisions of the future Convention to Polar regions in general was not the subject of discussions during the third United Nations Conference on the Law of the sea (1973-1982).

The latest agreements within the framework of the Arctic Council (on search and rescue at sea, oil spill response), as well as work on the Polar code regulating Arctic shipping, show the desire of Arctic

States to develop norms of behavior in the Arctic. There is no doubt that to “close” the Arctic once again is impossible, and economically impractical, but the rules of the game have to be offered exactly by those States, which coasts are actually washed by the Arctic ocean. The Convention remains only a kind of legal umbrella in the relation to these new arrangements.

The regime of the Convention itself over the past two decades since its entry into force has undergone significant transformations.

The regime of the open sea is becoming less free for implementation of certain types of marine activities. The implementation of the freedoms of the open sea is increasingly dependent on the performance of tasks to protect and preserve the marine environment and its biological diversity. Given that beyond the 200-mile exclusive economic zones (EEZ) of the Arctic States is an enclave of the open seas, these transformations are crucial for them.

The practice of expanding the powers of coastal States in areas of their jurisdiction is going on, primarily in the EEZ. Despite the fact that the costal countries are not endowed here with any competence in the field of security, practice of broad interpretation of the concept “security” implies the existence of such its species as food, resources, and even environmental one. Their provision is becoming more common, although it leads to certain restrictions on the rights of third countries. These aspects must also be considered when determining the management regime in the Arctic.

Also we should note that the regime formed by the Convention, is largely fragmented. About 40 countries of the 166 Convention participants are not fulfilling their basic provisions or allowing a broad interpretation of some of its articles.

In the Arctic the situation is compounded by the fact that the major marine and naval powers - the United States- still has not ratified the Convention. Their nonparticipation is not simply a diplomatic nuance, as the Americans try to present themselves, this is a serious international legal problem.

The United States really adhere to most of the provisions of the Convention, considering that it has codified established rules of customary law. However, the Convention is not only a codifying docu-

ment; it has introduced new rules that while not becoming a widespread practice cannot be considered as customary law. All this and the provision to define the outer limits of the continental shelf, and the concept of “Common heritage of mankind” are brought norms, and the US has a potential possibility of their failure, which puts them in a more advantageous position. In addition, there are areas where the United States allow themselves different, often expanding interpretation of the Convention's norms that do not coincide with the opinion of other States (e.g. different interpretation of what falls under the category of marine scientific research is the reason of long-standing conflict between Washington and Beijing).

China, fiercely rushing to the Arctic, is of even greater concern, not because of the level of its rising economic power and political influence, and legal nihilism. One gets the impression that cautious, and sometimes skeptical attitude of Beijing to the norms of international law is due to its perception as a product of Western civilization, which we can safely ignore their interests. China is a record-holder in the field of violations of the Convention's norms, its initial position in adjacent marine regions does not correlate with the provisions of the Convention. However, this does not prevent China to insist on the need for strict adherence of Russia to the Convention's norms in the Arctic [67].

It is hardly correct to compare the Arctic with the Baltic or the Mediterranean regions in respect of which the Convention provides for the need for regional-level regulation. However, is it right to identify the Arctic ocean, for example, with the Indian on such parameters as area, depth, ecological vulnerability, and finally the history of development and use? It appears that the Arctic should be applied to with a special format, based on a combination of global and regional approaches. For example, a regional level of responsibility is capable of preventing an environmental catastrophe here. And as the main criterion for admission here from other States should not be the financial and economic interest in the development of spaces and resources, and the willingness to contribute to the study of the Maritime region, to enrich the database of knowledge about the processes ongoing here.

The Antarctic region (territories south to 60° of South latitude,

including the South pool of the World ocean, usually called with a general term the Southern ocean), despite its remoteness and harsh climatic conditions for many of the States are of not less interest than the Arctic. In contrast to all other continents, since its opening in 1820, Antarctica remains essentially no man's land. More precisely, the rights to it were sued by seven countries at once, but their claims still remain largely unrecognized.

The discoverers of the Antarctica are considered to be Russian navigators Fadey Bellingshausen and Mikhail Lazarev. On 28 January, the participants led by them expedition were the first people who saw the icy continent. Just two days later to the shores of Antarctica came ships as part of the British expedition led by Edward Bransfield. The first who happened to land on the continent, presumably, were the American hunters led by captain John Davis. In search of the seals 7 February 1821, they landed on the shores of Western Antarctica, where they spent about an hour.

The first claims on land in Antarctica in 1908 were made by the Great Britain which declared sovereignty over a number of Islands next to the already belonging to the British crown the Falklands. However, at that time London “took” a small piece of Antarctica, but later, in 1917, the British Antarctic territory was declared an entire sector of the continent (all the way to the South pole), bounded by the 20th and the 80th degrees of West longitude.

Claims of other countries on the southern continent were formalized by the same way – in the form of sectors. In 1923 London “attached” to submissive New Zealand the Ross Territory – a narrow stretch of Antarctica between 150 degrees East and 160-m degrees West longitude. It was staked for the British crown already in 1841 by navigator James Clark Ross, However, officially the Royal possessions of land were declared only 82 years later. Australian Antarctic Territory was transferred to the metropolis of its former colony in 1933. It occupied the sector between the 44th and the 160th degree of the East longitude.

In 1924 the territory of the Antarctic – Adelie Land – was acquired by France, which applied for claim on the land opened in 1840 by the Explorer Jules Dumon-Dorvil. This sector was limited by 136th

and 142nd degree of East longitude and wedged in the Australian Antarctic territory, with what the British agreed.

Another Antarctic power appeared in 1939 – then the sector between 20 degrees West and 44 degrees East longitude was declared to belong to Norway. The territory was named Queen Maud Land - in honor of the wife of the Norwegian king Haakon VII, Maud of Wales. Chile and Argentina were the latest in 1940 and 1942 to officially claim on Antarctic territory. At that the segments specified by their authorities overlapped not only each other but also to the British. Another plot, Land, Marie Byrd located between 90 and 160 degrees West longitude, and is still vacant – official claim on it was not put forward by any country in the world.

The situation around Antarctica, from the very beginning threatened with a major international conflict. The claims of seven States to Antarctic territory expectedly elicited objections from many other countries – both those that also claimed a piece of the continent, and others that preferred to see Antarctica as a neutral territory. Uncertainty over the status of Antarctica also complicated research work: by the mid-twentieth century, scientists had actively used the continent as a unique research platform, and the presence of national segments did not contribute to international cooperation.

Attempts to discontinue the division of Antarctica in the late 1940s were made by the US and India. However, meetings and conferences conducted by them did not give any results. Progress had been achieved only in 1959, when 12 countries signed the Antarctic Treaty – a kind of international code of conduct on the continent. In addition to seven of the candidate countries for the territory in Antarctica, signatures under the document were signed by the representatives of Belgium, the USSR, the USA, South Africa and Japan. All of them at the time of creation of the Treaty were active on the continent studies. Now the number of signatory countries has increased to 50, and only 22 of them have the right to vote – those whose researchers are most actively involved in the study of the Antarctica.

The core of the agreement was the premise that Antarctica is declared a peaceful area where it is forbidden to place any military bases, conduct maneuvers and testing weapons, including nuclear. In-

stead, the region should become a platform for large-scale scientific research, the results of which the parties were free to share.

No less important was the political aspect of the document: according to his Sixth article, it actually froze all territorial claims on Antarctica. On the one hand, the contract was structured in such a way that attempts on its basis to challenge the claim of a party was simply impossible. On the other hand, the “owners” of the Antarctic territories did not gain any tool in order to confirm its sovereignty over these areas. As a result, it was deprived of the arguments of both camps – those who had territorial claims in Antarctica, and those who did not agree with them. At the same time, the Treaty established the principle of free access of its members to all parts of the continent.

Eliminating the danger of a political conflict, the Treaty, however, left beyond another equally important issue: access to minerals. As suggested by geologists there are large deposits of many resources in Antarctica: coal, iron ore, copper, zinc, nickel, lead, and other minerals. However, the greatest interest for most of the countries is oil and gas reserves. The exact amounts are unknown, however, according to some, only one region of the Ross sea (Australian sector) contains about 50 billion barrels of oil and 100 trillion cubic meters of natural gas. For comparison, Russia's reserves of these raw materials amounted to 74 billion barrels and 33 trillion cubic meters respectively.

An attempt to discuss the possibility of mining the participants of the Antarctic agreement made in 1988 by adopting the Convention. However, the document never entered into force, but instead in 1991 the parties signed the Madrid Protocol, which entered into force in 1998. According to this document, is strictly prohibited any extraction of minerals on the territory of Antarctica. However, this ban is not indefinite: the text of the Protocol should be revised 50 years after its entry into force - in the year 2048. At that in some countries claiming territory in Antarctica, they do not exclude that in the end, the industrial development of the continent can be resolved. In addition, there is a possibility that someone from the parties to the Protocol will simply refuse to participate in it.

Obviously, such scenarios give rise to concern, especially to those countries that believe that Antarctica is theirs. In practice, this

has led to the fact that during the execution of the provisions of the UN Convention on the law of the sea, which entered into force in 1994, a serious conflict arose because of the need to determine the boundaries of the continental shelves. On the Antarctic shelf, there have been applicants from among the “owners” of the continents. On the other hand, the Antarctic Treaty directly prohibits its participants to increase their holdings.

However, the solution was found. Three countries – Australia, Argentina and Norway emphasized the coordinates of the alleged offshore possessions in the Antarctic, though, asked the UN not to consider their status until the resolution of the territorial dispute. Three more countries – New Zealand, France and Britain – just reserved the right to submit the request later. The only state of the seven, which has not stated its position, became Chile.

The submission of “Antarctic” applications sparked a flood of objections. Of course, Britain and Argentina were first to start arguing, they claim to the same territory (in addition to Antarctica and they are trying to challenge each other the Falklands and other Islands in the South Atlantic). Representatives of Russia, USA, Japan, the Netherlands, India and other countries filed statements about the need to save “no man's” status of Antarctica.

Yet few dare to conduct open conversations about mining in Antarctica. Meanwhile, around the icy continent obviously nervousness is growing: almost any gesture of any country in its direction is immediately perceived by contractors as an attempt to push the “legitimate” owners.

For example, the report of the Institute of international politics named after Lowy (Lowy Institute for International Policy), prepared in 2011 for the Australian authorities, describes Russia's actions as the real economic expansion [69]. “In a government decree from 2010 on Antarctic strategy until 2020 it is peremtorily stated about the significance of Antarctic resources for energy and economic security of Russia, - wrote the authors of the report. As a priority public policy objectives references a comprehensive study on mineral and hydrocarbon resources are mentioned, and the development of “progressive” policies, designed for the discussion of the situation after the year 2048".

On the one hand, this strategy is only about “geological-geophysical investigations, which allow to make the necessary forward-looking assessment of mineral and hydrocarbon potential of Antarctica". In other words, the authors of the program suggest not to get fuel, but only to explore it. However, on the other hand, purely scientific interest is hardly a prerequisite for such studies. In particular, if a “comprehensive study of mineral, hydrocarbon and other natural resources of Antarctica” is intended to contribute to “the strengthening of economic potential of Russia".

In a similar way Australians evaluate the activities of the Chinese, the purpose of which is entitled “assessment of potential resources and methods of their use". The report's author almost blames Beijing's Imperial ambitions: according to him, on one of the polar stations “hanging sign “Welcome to China,” indicates the desire for isolation and the refusal to recognize the claims of Australia".

It is obvious that in anticipation of the expiration of the moratorium on mining nervousness around the Antarctic will only increase. Thus the probability that in the conditions of growing needs in the mineral resources the ban on exploration and mining of minerals will last forever, is not very large. It is not excluded that in order to prevent a full-scale confrontation a new agreement will be signed regulating the work in Antarctica and on its shelf.

3.2 THE EFFECT OF MINERAL WEALTH ON ECONOMIC, POLITICAL AND SOCIAL DEVELOPMENT OF THE COUNTRY

The countries that possess significant reserves of minerals, face special opportunities and special problems. In 80s of the twentieth century the hypothesis of the resource curse was born or paradox of plenty. In various studies, including the famous work of J. Sachs and A. Warren [151], the authors tried to prove the relationship between natural resource abundance and poor economic development of the country. The opinion was confirmed that states with significant reserves of minerals are less economically developed than countries with smaller reserves of minerals or with a complete lack of deposits.

From 1980 to 2006 income per capita fell by 6 percent in Venezuela, 45 percent in Gabon, 85 % in Iraq. Countries such as Algeria, Angola, Colombia, Niger, Sudan, and Iraq again during the decades suffer from civil wars [87, 88].

The main possible causes of the “resource curse” :

- reducing the competitiveness of other sectors of the economy caused by the increase in the real exchange rate associated with the inflow of revenues from the extraction and sale of mineral resources;
- the high volatility of resource revenues in the world market due to high volatility in prices of mineral raw materials;
- errors in the state regulation or the development of corruption related to the inflow of “easy” money to the economy;
- the lack of any real motivation and the real need for the development of the real production sector, as commodity revenues make it relatively nice to live in the current state system (congestion and stagnation).

However, practice shows that many countries also have significant reserves of different minerals (Australia, Brunei, Spain, Canada, Norway, USA, some countries of the Persian Gulf), but at the same time having a diversified economy and strong democratic institutions, have achieved a high level of economic development and per capita income.

In 2007-2008, the ambiguity of the impact of resource wealth on economic growth led to the change of the hypothesis of “resource curse” to hypothesis “conditional curse", according to which the abundance of resources can have both positive and negative effects on economic growth depending on the quality of institutions. Today it is proved that in conditions of low quality of institutions in the economy of its high natural resource endowments leads to negative socio-economic and political consequences, such as the establishment of an authoritarian political regimes, increasing frequency of civil conflict, economic slowdown, corruption [2, 101, 138, 149, 151], and even fewer economic and political rights of women [149]

These effects are not strictly determined, and occur only under certain conditions. As shown in several papers [2, 101, 138, 149, 151]

in countries rich in mineral resources, the political regime is on average less democratic than in other countries. To explain this fact following reasons are named:

- in countries with autocratic regimes income derived from the resources operation resource can be used primarily for funding of power structures, which remain the regime and the suppression of the opposition;
- revenues from mining provide an opportunity of autocratic regimes to purchase populist policies, for example, to reduce taxes or finance social programs cost in excess of the permissible limit, providing the support of the majority and reducing the popularity of the opposition;
- in countries where the economy is dominated by the mining sector with its relatively simple technology, the share of skilled labor is less, as a result, civil society develops a slowly and the demand for democratic institutions is relatively low;
- democratization in the conditions of undeveloped democratic institutions may lead to slower growth. If the population is aware of this connection (e.g., as a result of previous experience), it will not seek to democratization [2, 138, 149].

Another side of resource wealth effect on the political system is the instability of democracy. The main idea of this statement is the following: if the country is rich in dotted natural resources, their owners ("oligarchs") receive a significant economic power. In a democracy with weak public institutions, they can carry through Parliament the best decision for them, bribing politicians, so that the economic power turns into political. Distortions in the policy and the fact of political corruption cause the main part of the population not employed in primary sector, dissatisfaction with the current government and, moreover, the democratic form of government as such. A potential autocrat gets the opportunity to come to power, either giving populist promises supported by the population, or by concluding an Alliance with the “oligarchs". In the work [138] the hypothesis of the destabilizing influence of resource wealth on democracy is confirmed by econometric calculations.

Countries whose economy is mainly based on the extraction of

minerals are at high risk of conflict-related violence, but this requires the presence of certain conditions. These include the relative poverty of the country and production of at least part of the minerals or their processing in the region, the population of which are restricted in certain rights. Or there are criminal gangs or the rebels have the ability to sell rights to mine mineral deposits which they are going to capture in the future (the effect captured futures).

At the same time, resource abundance is able to exert the opposite, limiting the impact of conflicts. Mineral resources provide only an initial impetus to the emergence of conflict. Therefore, in the case where the volume of mineral resources allows you to pull the country out of poverty, there is a reduction in the risk of its civil war. Most at risk are those of low-income countries, which explored deposits make rebellion financially attractive, but they are not enough in order to make equally attractive peaceful civilian life.

The civil war in Angola broke out immediately after the liberation of the country from the bicentennial rule of the Portuguese colonialists. The war began in 1975 and continued intermittently until 2002. The armed struggle was between the two main political forces: the socialist peoples movement for the liberation of Angola (MPLA) and the National Union for the total independence of Angola (UNITA).

Angola has vast mineral resources, especially oil and diamonds. In the beginning of the conflict, UNITA captured the rich Angolan diamond fields, and the MPLA gained control over the oil fields. Thus, two kinds of minerals, being the source of huge riches, were led by two different political forces which fought with each other. Diamonds and oil were provided to both sides of the conflict, the wealth and power made them a reason to continue fighting. Citizens of Angola, directly affected by the conflict, fell into terrible poverty.

In the period from 1992 to 1998 in order to finance the fighting, UNITA sold diamonds to the amount of 3.72 billion U.S. dollars. Realizing the role of diamonds in funding UNITA movement, in 1998, the UN adopted 1173 and 1176 Resolution of the UN Security Council, banning the purchase of conflict diamonds from Angola.

In 1998, the British NGO Global Witness published a report on the impact of the illegal trade of diamonds in the continuation of the

military conflict in Angola [9]. The report argued that diamonds were used by UNITA to rearm to continue the war, which claimed over half a million lives, and to conceal huge riches, which in the absence of documentary registration of transactions, could uncontrollably move from hand to hand. The UN bans for sale were often violated, and the offending company had never been punished.

The following year, Global Witness released another report, which was dedicated to the oil industry of Angola [4]. Oil remained the main source of foreign exchange earnings in the country and at that moment provided 90 % of government revenues. It was stated in the report that a considerable part of the wealth from oil production was assigned to corrupt officials and not used for reconstruction. The primary user of the subsoil for hydrocarbon production in Angola, British Petroleum (BP) was proposed to publish all the data about payments to the Angolan government in accordance with the contracts, and that BP did. Having decided on such an unprecedented step, the company hoped to force the Angolan government to use oil revenues for the needs of the population. In the long term, this could reduce the amount of tax and additional tax payments that BP would have to pay (at the time the Angolan government constantly appealed to the company for more money).

These events led to the appearance of the initiative "More openness in the extractive industry (Extractive Industries Transparency Initiative, EITI). In 2002 at the world summit on sustainable development in Johannesburg a mechanism to encourage countries to publish data about payments received from companies extracting minerals and the expenditure of these revenues to carry out the necessary comparisons was offered.

EITI provides a solution to the problem of the resource curse, which often suffer developing countries only partially. But in any case, the desire to ensure financial transparency remains a prerequisite for further progress.

It should be noted that the "resource curse" is a recent phenomenon. At the end of the nineteenth century, resource-rich countries grew faster than countries who were deprived of them. Modern economic problems of resourced developing countries are a consequence of glo-

balization, interaction with more developed countries of the West. The most important factor here are:

- the gap between the prices of mineral resources on the world market and efficiency of their use in developing economies;
- premature attempts to simulate the policies on import tariffs, subsidies, accumulation of reserves, carried out in more developed countries [138].

For a country rich with resources, the removal of the relevant natural resource rents through taxation of the resource sector it seems appropriate-different, because of the nature of the technology of natural resources extraction and high profitability in this sector of the economy it is expected that this tax will have little distorting effect and will not lead to a significant reduction in production. In addition, as it can be seen from many works dedicated to the “Dutch disease", it is reasonable to restrain the growth of the resource sector, to prevent the outflow of physical and human capital out of high-tech industries.

The policy of withdrawing the most part of resource rents is carried out by many countries that export natural resources. So, in Norway, the government seizes about 80 % of the oil rent.

However, it is not enough just to collect taxes, you must also properly dispose the seized resource rent. A passive strategy is just to keep the revenues from commodity exports, adding to foreign exchange reserves and the stabilization fund. In addition to greater resilience to various macroeconomic shocks (particularly to changes in world prices of natural resources), the consequence of this policy is the weakening of the national currency, favorable for domestic producers in export and import-substituting industries and contributing to the increase in long-term growth. The drawback of passive policies is withdrawing from the system resources that could be used to invest in production or in the development of new technologies.

In the last forty years under the influence of world prices international division of labour is emerging, in which the abundance of resources and relatively cheap labor force developing countries to rely on the mineral resource sector to the detriment of the development of high-tech industries.

Another basic prerequisite for effective use of revenues from the

extraction of mineral resources is the ownership of the mineral resources, contained in their resources, the transparency of the procedures for obtaining the right of subsoil use.

In order to make mineral resources more powerful tool for providing high temp of social and economic development of the country independent group of economists, lawyers and political experts worked out principles of their production and usage [111]:

1. Resource management should be based on a comprehensive national strategy, within a clear legal system and thus to provide the greatest benefit to the citizens of the country mining these resources;
2. The decision makers in the field of natural resource management must be accountable to the public;
3. The government should encourage efficient exploration and mining companies, and mechanisms for granting rights of subsoil use must be transparent;
4. Tax regimes and conditions of subsoil use should be unchanging even in changing circumstances and to ensure the government is getting maximum income from the attracted investments;
5. The government must constantly find new ways to get local communities benefit from the exploitation of resources, found on the territory where they live, and to ensure the minimization of negative impacts on the environment from mining;
6. National resource-extraction companies should be accountable and cost effective;
7. Revenues from the exploitation of resources need to be invested by the government in such a way as to ensure the interests of present and future generations;
8. The distribution of revenues from the extraction of resources by domestic spending should be balanced and take into account the volatility of the prices of mineral resources and accordingly the volatility of income from its sale;
9. The government should use the revenues from the exploitation of resources as an opportunity to improve the efficiency of state spending at the Federal and regional levels;
10. The government should support private investments in the

mining industry and the diversify the economy;

11. Resource companies should strive to achieve the highest environmental and social standards as well as standards in terms of compliance with human rights and sustainable development;

12. Governments and international organizations should introduce higher and higher standards to support sustainable development.

In addition to the above risks (the establishment of an authoritarian political regimes, increasing frequency of civil conflicts, economic slowdown, corruption), according to M. Ross, the presence of large hydrocarbon reserves leads to restriction of the economic and political empowerment of women, because in such countries they are deprived of the opportunity to get a job in the service sector and the public sector easily (in the oil-rich States most of the new jobs are created in these segments). Unfortunately, this condition is widespread in the middle East and North African countries.

Such immunity from the impact of oil wealth is owned by countries where women have access to the growing service sector and the public sector or their governments are using other ways of involving women in the workforce (e.g., Mexico, Syria and Norway). As long as woman have sufficient political influence needed to eliminate barriers to their participation in the workforce, avoiding of this kind of problems allows to set meaningful gender quotas for elected positions [149].

Besides the greater involvement of women in the workforce allows achieving the reductions of fertility, the demand for migrant labour, and thus slowing of population growth, delivering the ultimate long-term economic success of the countries, mineral-rich countries.

CHAPTER 4

GEOETHICS BASED RESOURCE MANAGEMENT

Essential features of mineral resources (deficiency, limited amounts, exhaustibility, non-renewability and their belonging not only to currently living but also to future generations) impose a dilemma of how to sustain economic growth to satisfy constantly growing demands of growing population of the Earth without damaging the environment.

4.1 THE TRAGEDY OF THE COMMON

In 1968, Garret Hardin, American Ecologist published an article in Science magazine about specific features of resource consumption, the use of which is available to everybody [71]. According to G. Hardin, the World Ocean and the atmosphere, national parks and pastures – all these resources will be exhausted if total access to such is not limited one way or the other, the primary of which is limitation of population growth.

Let us take an imaginary village community, where there is only one pasture available. Any member of the community can graze their cattle as and when they want. Pasturing reduces the amount of grass that grows there, and consequently. It reduces the profit from cattle breeding. Each community member may increase the number of their cattle and increase their own income while slightly reducing the pasture fertility. However, if all community members do the same, the pasture will become significantly worse. If the community members reduce the frequency and time of grazing, the pasture fertility increases, but member personal benefit would be much less than the lost income.

It gets to the situation, when each community member gets most benefit only by increasing the use of the pasture, and not a bit less. The temptation of instant income is so great to reduce voluntary reduction of the use of cropping area. In addition, this leads to complete

exhaustion of the pasture. “In any society, where free use of common use resources is an axiom, then all its members, by acting in their own interests, anticipate its ruining by each step they take. Free use of common resources turns into overall ruining”. [71]

This is an inevitable process; form the point of view of G. Hardin, “in a crowded world of less than perfect human beings”, he called this “the tragedy of the commons”, having borrowed the term from William Forster Lloyd’s book 1833 about population.

The idea of exhaustion of these common use resources by free use is not a new one. Long before H. Hardin, in his paradigmatic work “Politics” Aristotle wrote the following: “The thing, which is the subject of ownership of large numbers of people is least cared after. People tend to care more about things, which belongs to them personally and they care less about anything that is generally owned”.

In his scientific researches, G. Hardin keeps returning to the issue [70, 72, 73].

“Drifting in the Sea of Morals… we sit in a lifeboat, where 50 people are seated. Let us assume, the boat can take ten more people, which will make a total of 60 of us. In addition, there are 100 more shipwreck victims floating around us on ship wood pieces and begging us taking them on board... We have several options: we may be tempted to try to live by the Christian ideal of being “our brother's keeper,” or by the Marxist ideal of “to each according to his needs.” Since the needs of all in the water are the same, and since they can all be seen as “our brothers,” we could take them all into our boat, making a total of 150 in a boat designed for 60. The boat swamps, everyone drowns. Complete justice, complete catastrophe....

Since the boat has an unused excess capacity of 10 more passengers, we could admit just 10 more to it. So, which 10 do we let in? How do we choose? We will survive, but we will have to be aware of the others, who are trying to get on board by force” [73].

G. Hardin used the lifeboat metaphor as a response to the spaceship metaphor widely used by the environmental protection professionals. According to the latter metaphor, everybody is the equipage of the spaceship “Earth”, where our duty is not to waste its resources. The problem arises when the metaphor reaches its culmination – the

big happy ship crew, where each member works for the general benefit. In this case, the resources are considered to be the property of the entire humanity and common use access for everybody is declared, which, as in the example of the community pasture, leads to uncontrolled use and ruining.

G. Hardin's logical structures were based on the assumption that the world with finite resources can supply a limited number of people, therefore, the humanity must stabilise the number of population by bringing the population growth to zero. Common use access of resources, if it can be considered justified at all, exists only in rare density of population.

It is known from our history that as the number of population grows, we have to exclude the possibility of common use of resources in various fields one after another, for instance:

- In food supplies by fencing agricultural lands, limiting access to pastures, hunting and fishing areas;
- In waste utilisation by trying to introduce high rates for negative impact to the environment to protect the common use resources from contamination by industrial waste and effluent, pesticides, nuclear energy sites, etc.

The target of "maximisation of benefits for maximal number of people", defined by J. Bentham, founder of utilitarianism (Benthamism) remains unattainable primarily due to the impossibility of simultaneous maximisation of two (or more) variables from the point of view of mathematics; maximum increase of the number of population would not lead to maximum increase of goods to be used, especially in conditions of constant expansion of the list of necessary needs and quantitative increase of their volume.

However, what is a benefit? In its generally accepted meaning it reflects everything that can satisfy daily life needs of people, provide benefit to people, bring pleasure to them. From economically-socially benefit is considered to be everything that has price and can have a market value, consequently, in its broad meaning all property holdings. A subject is considered to be benefit upon availability and coincidence of the following four conditions:

- Human demand;

- Properties of the subject make it useable to be presented in a causal connection with satisfaction of such demand;
- Understanding of such causal connection by humans;
- Possibility of disposing the subject in a manner to really use/consume it for satisfaction of such demand.

For some people benefits are pits, shafts and mines for mining of minerals, for others – old-growth forests, clean air, rivers and lakes that have been preserved in their original feature, while for the third type of people – agricultural lands that can be obtained by cutting some old-growth forests and ruining of landscapes, thus ensuring their life here and now, etc. How can they be correlated and proportioned?

In nature systems, the criterion for proportioning is survival of species in natural selection processes, when the nature weights the comparative value of each variable. Having reached highest level of development, standing at the top of evolution and being hardly the only flourishing species of livelihood in our close system, which our planet is at the moment, humanity is itself trying, maybe unconsciously sometimes, to model this natural proportioning process: in most cases, when there is a dilemma of survival of the population of a district, region or a country due to use of natural resources, the proportioning is resolved in the benefit of people.

G. Hardin saw solution of the problem of finiteness of resources by either controlling the birth rate that ensures optimal number of the population or in readdressing the issue of our individual freedoms to clarify the types of such freedoms that are really justified and could be kept. For protection of natural resources form degradation, Hardin proposes the following:

- develop acceptable criteria of assessment for proportioning the resource values, by realising that this task is difficult to resolve;
- upon creation of the above criteria, introduce an administrative system of "coercion at mutual consent" [71].

G. Hardin's thesis of government administrative structures that are capable of ensuring moderate use of natural resource through legal methods causes an eternal question: what error correction mechanism of feedback should we establish to ensure that the "controllers" remained honest?" All attempts to develop regulatory measures in this

field go through the same "life cycle":

1. Population indignation upsurge develops in cases of irrational, unjust use of one or other natural resources;
2. The state forms some kind of a regulatory body (ministry, service, commission or a counsel), established to ensure rational and just natural use;
3. Some symbolic guaranteed are ensured to those who have suffered from consequences of irrational and unjust natural use;
4. Upon commencement of the activities of the regulatory body, some calming sets among most of those, who have suffered and those who are interested in rational use of resources; all these people, as a rule, are not united in a specific organisation;
5. Upon settlement of calmness, highly organised groups with specific interests, who wish to achieve some preferences and privileges in exploitation of natural resources, proceed with lobbying of their interests and put pressure on the regulatory body;
6. The regulatory body members are selected from amongst those, whose activities should be regulated by this body [39].

Thus, upon availability of a general system of values, supported by the administrative system of "coercion at mutual consent", the potential of saving the common use resources from the privileged use, which H. Hardin hoped for, is not obvious.

Long before H. Hardin, in his paradigmatic work "Politics" Aristotle wrote the following: "The thing, which is the subject of ownership of large numbers of people, is least cared after. People tend to care more about things, which belongs to them personally and they care less about anything that is generally owned".

Based on almost thirty years of studies of the many examples of management of commonly owned properties by various unions of their users worldwide, in 1990, in her work [133], Elinor Ostrom, Nobel prize winner, demonstrated efficient mechanisms of management of common use resources, thus denying the generally accepted thought about the incapability of the society to cope with management of property as opposed to the state or private capital. In Nobel Committee declaration, they noted that Ostrom disclosed the widespread idea about inefficiency of collective management of property, and

that it should either be privatised or nationalised. “Having studied the many examples of community regulation of fishing, use of pastures, forests, lakes and ground waters, Ostrom demonstrated that in many cases the results appear to be significantly better than standard model assumptions. She disclosed the laws of formation of complex practices of decision making and ensuring relationships that are intended for successful regulation of conflicts of interests”. In the process of establishing and management of their own institutions, some cooperatives, people create such mechanisms of economic management that allow, on one hand, prevent from exhaustion of the resources in use by them, and on the other hand, efficiently resolve any arguments and conflicts that are caused in the process of exploitation of the resource.

The main objective of E. Ostrom’s studies was development of principles of understanding the “social-environmental system” (SES) that considers the natural resources and human interaction as principally important components of modern economy.

We shall discuss one of the examples that E. Ostrom described. Back in 1435, in Valencia, Spain, the local people organised autonomous irrigation communities intended for management of general lands. The basic rules have not changed to-date. Water distribution is subject to decisions of irrigational community officials depending on the situation whether there is abundance of water, its seasonal fall in volume or extraordinary drought. In water abundant year (which happens sufficiently rare), the farmers are allowed to take as much water as they require once the water reports to the canal that serves their lands. A more standard situation, when the irrigation canal system functions is seasonal fall of water. Once people face this situation, water reports to specific farmers via a complex irrigation system that works in accordance with a lot rules. Without implementation of such irrigation system in this region of Spain, where precipitation level varies annually, development of agriculture would have been impossible.

The main rule for distribution of water is that the landowner receives the amount of water proportional to the square area of his lot. In addition, each farmer can use the water resource only once his turn arrives, and once he misses his turn, he can use water again only once his next run arrives.

The chief managers of communities take part in two judgement seats that are held weekly. In case a conflict, the chairperson interrogates the conflicting parties, while the court members, save the community members, whose canal is considered in the case, immediately draw a decision on the case facts guided by specific rule that are in force in connection with the specific canal. The imposed fines and damage compensation amounts are also agreed with the rules of the given canal. This form of distribution of general use resource proved its efficiency for over many centuries.

Why has this been possible? According to E. Ostrom, this is explained by the following factors. An all similar locations there is a large number of guideline sets, which determine the boundaries (which are very narrow) of "due" behaviour. Many of these norms allow people live in a condition of various type heavy interdependences, which help them avoid unnecessary conflicts. In addition, "reputation of a person, who keeps his word, an honest and reliable person, which he has within the place of his residence, represents a valuable asset". Willing to follow the "due" behaviour" rules, the person follows his long-term interests.

During the process of use of common use resources, individuals constantly talk to each other and interact with each other in a localised natural environment. So, encountering those, who can be trusted; realising the consequences that their actions may cause to themselves and to the entire resource system becomes quite possible.

Self-organisation is also a very important factor. It allows learning to get mutual benefit by avoiding total damage. "When people live in such conditions for a sufficiently long time and if they have developed generally shared behavioural norms that are based on mutual responsibility, they develop a social capital, which helps them establish institutional instructions that allow them resolve common use resource dilemmas", notes Ostrom. In locations, where individuals follow the rules and carry our mutual supervision, stable institutional arrangements and individual strategies support each other.

E. Ostrom writes that there are no universal rules. Each case is unique. The important thing is understanding whether there is any trust between the arrangement parties and whether they are ready for

cooperation. Life experience shows that in certain circumstances, people can create original schemes that cannot be reviewed in a single classification; however, they do exist and are efficient.

By establishing certain organisations as a specific variation of cooperatives, people invent interesting methods how to use resource sources and resolves conflicting issues for the purpose of achieving efficient results in the activity at economic sites they manage.

E. Ostrom disproves the aforementioned theory of H. Hardin, according to which social property is recklessly exploited by users, and therefore it is necessary to either privatise it or strictly regulate by the state. She proves the fact that resource user communities are fully competent of managing the social property. Collective ownership can be successfully managed. Management of social resources should not be limited by state regulation or privatisation of the site.

E. Ostrom's studies seriously challenge the main economic and politological concepts. On one hand, there exists a scientific tradition, which is based on the Adam Smith's theory of social order. Adam Smith and his successors concentrated their efforts on the model of the "spontaneous order" and positive role of independent actions of individuals, who pursue their own interests within the framework of established systems of market economy norms. Another scientific trend originates from the theory of Thomas Hobbs' social order. According to this concept, actions of individual, who are guided by their own personal interests and commit themselves to maximise their own welfare, will inevitably lead to chaos and conflicts. This predetermines the necessity in a unified centre of power that ensures due order. According to Hobbs, social order is a process of giving birth to a unique sea monster – "Leviathan", which processes monopoly authority for development of laws and supervision of their adherence.

According to E. Ostrom, supporters of both scientific trends were cute enough to not only carry out theoretical studies of market and state separately, but also separate the very concepts of these two phenomena with a dead wall. In her studies of common use resource management, E. Ostrom attempted and successfully implemented her attempted to eliminate the dichotomy of modern economic theory, which is based either on boasting of the nature of the market or ad-

dressing to the state as the saviour from its unpredictability. Ostorm notes, – "Existing of order in the world is mainly dependent on the theories, which we use to conceptualise the world. However, we are not limited by those concepts of order that are based on the books of Smith and Hobbs". We require a theory that "represents an alternative, which can be applied for analysis and practical development of various institutional structures that correspond to the multitude of existing common benefits".

According to this requirement, E. Ostrom studied various institutional systems that belong neither to the market no to the state. We are talking about commercial and non-commercial structures, who produce common benefits for "collective cells of consumption". She managed to show that resource user communities usually produce efficient and very complex mechanisms of decision making and resolving conflicts.

Describing Ostrom's theory as a whole, we may not ignore "Coase's theory" [34, 35]. R. Coase insists that for efficient management of fields, rivers, air etc., correction distribution of rights and minimisation of transaction costs is important for the state. Only in his case, people and companies can come to an agreement with each other. However, on the contrary, if the costs are high, the state regulation may not be able to cope with the situation.

Having studied social resource management regimes in different situations, E. Ostrom drew a conclusion that R. Coase is not always right. Sometimes people reach optimal solutions by introduction of different behaviour norms, without participation of the state or without clearly marked markets. What should the rules and norms of collective management be according to E. Ostrom's theory? Ostrom defines the following five main rules and norms for efficient collective management of common property:

1. Clarity of boundaries (limitations) and rules. (When people are aware of what is acceptable and what is not acceptable; it is easier for them to adapt their actions to others' expectations. It is obvious that a general rule works best when all expectations are clear. In that case, people can interact peacefully and fruitfully, and conflicts are minimised);

2. Development of rules at the local (grassroots) level. The closer someone is to the situation, the more he knows about it. E. Ostrom thinks that introduction of rules locally reduces costs with information transfer and promotes development of initiatives "from the bottom";

3. Active participation of users in management of commons resources, monitoring and controlling of their use, i.e., the ones who are mostly interested/concerned, must either directly participate in management or delegate their supervisors, who will report to them. At the same time, centralised management bodies represented by government officials cannot be efficient and subordinate supervisors for, usually, they are not directly subordinate to the users of these or other natural resources. If those, who need resources, cannot dismiss those, who cannot protect these resources, tragedy is inevitable;

4. Dispute solution methods. Dispute arise all the time, therefore, their solution methods are necessary, and such methods are in active use at the current time. There should exist certain arrangements that allow the parties know beforehand how any conflicts would be resolved. Disputing parties must also agree to cooperate with the third party in solution of their conflict;

5. Sanctions against violators. It is natural that those, who have been classified as wrong by arbitrators, and more over those, who put themselves "outside the law" by refusing to accept the third party arbitrations, shall be forced to agree by proportional sanctions.

Such rules, which have been in practice successfully at small communities, often cause doubt in their applicability to regional and national levels, save the global level, populated by people with different life style, worldview, religious beliefs, etc. In her later work [134], dedicated to development of a rational collection theory of collective action, E. Ostrom added three more rules:

1. Strict definition of the number of common use resources and efficient refusal to access to the resources from outside;

2. The self-determining community must be acknowledged by high rank authorities;

3. In case of large amounts of common resources, organise inbuilt organisations as multi-layered structures with small amounts of common use resources at the basic level.

These rules can be altered and expanded in such a way to include a number of additional variables, which can influence the success of the self-organising management systems, including efficient communication, internal trust and mutuality/return, and the nature of the resource system as a whole. E. Ostrom warns from establishing of a unified government institution globally for initiation and coordination of collective actions against degradation of common use resources. Partly, this is associated with the complexity of functioning of such organisation, and partially with the necessity in diversification of subjects, involved in resource management. Her suggestion concluded in application of the polycentric approach, when key management decisions must be taken as closer to the location of event as possible and always by the participants themselves, when this is passible.

E. Ostrom discusses an example of the following theoretical situation. A group ten farmers owns farmers of approximately same size. A small river runs along these land lots and all farmers use the river. Every year they face one and the same problem of defining a working day for collective cleaning of the territory from fallen trees and fallen leaves from the previous year. No farmer thinks of stopping his agricultural work. Let us assume that the amount of water in the river depends on the number of days, dedicated for cleaning by the farmers. But the farmers would get more profit by continuing work at their farms as opposed to by cleaning the river. Therefore, each farmer would want others did some cleaning while he would miss this work. However, the price of participation of each farmer in this collective work is much higher than the costs of cleaning the river.

If the group is not large, then it is not difficult to organise a meeting of people in person and have a talk. It would not be difficult to agree as how to honestly distribute the work for they have common interests and the farms are almost of the same size. It is necessary to reach a simple decision – fix a day of cleaning, when each cleans the part of the river at their own territory. While discussing this issue, it is necessary to note the importance of participation of all farmers.

At personal meetings, they undoubtedly gossip about those, who had not participated at this common work previously, persuade them not to do that again, the may even threaten them not to allocate workers, if the others will not cope with the work. If the groups are nor large and homogenous, and potential costs for producing common benefit (goods) during a long period are relatively low, then we can definitely predict that any large group of people would find a way how to resolve a social issue together.

However, if we assume that another farmer buys 5 lots of land, he wants to cultivate the lots and plans to be doing this for a long time. In this case, there will be only 6 farmers around this location, one of which owns half of the capital. And if this farmer follows the rule, then it is quite fair to participate at the work, which is carried out in common interests and is rewarded respectively, then increase in heterogeneity will not be a compelling problem. The participant will agree, similarly that all this is happening all over the world, to participate in a joint work proportionally to the amount of land they own. If the new farmer has other notions of justice, then this small group may face a more serious problem than a larger group may have had at its increased heterogeneity (large number of group members).

But when these land lots are not bought by a farmer, but by a tenant builder for construction of country cottages, and the time is limited, especially for investments into irrigation, then the tenant builder would simply not see any benefit for himself in cleaning the river. Thus, this change will cause a number of other changes: change in the number of participants in the group; diverging interests and funds; existence of one participant, who owns half of the resources, but not for a long-term perspective, and without any interest in the work that is beneficial to everybody. This example shows that changes in a structural variable cause consequential changes in other variables and how difficult to build simple two-dimensional hypothesis on influence of one variable to the level of cooperation. In this case, it is more probable that a large group of 10 farmers will cooperate with similar parameters than a smaller group of 6 people. We should note that this conclusion is totally contradictory to the generally acknowledged view about influence of the size of the group to the level of cooperation [134].

We can draw a conclusion that in management of common use resources, groups can achieve a general benefit only upon existence of common target, by trusting each other, possibility of easy communication, institutional innovations (availability of regulatory and sanction rules).

4.2 MINERAL RESOURCE DILEMMA: HOW TO BALANCE THE INTERESTS OF GOVERNMENT, SUBSOIL USERS, LOCAL COMMUNITIES AND ABIOTIC NATURE

Over the past ten years, a number of exploration and mining projects in various countries have been delayed or stopped as a result of strong opposition from local communities.

Early in July 2013 the Argentine Government decided to cancel its agreement with the Canadian gold mining company Osisko (one of Canada's largest gold mining companies) to develop a gold mining project in the north-west of the country after the protests of environmentalists, despite significant social and economic consequences. Local authorities of the La Rioja Province were not able to achieve an agreement with local population community that resisted the project in the last two years with support from Greenpeace. The main ecologic concern was the use of cyanide and large volumes of water for the precious metal mining.

In April 2013, due to the local community protests, the Gaychursky ore-extraction and processing company located in the Zaporozhye region (Ukraine) lost its license to mine iron ore on the Gulyaypolsky deposit that was granted at the end of 2012. Also in Ukraine, since January 2013, when Shell and the local company "Nadra Yuzivska" signed a joint venture agreement to develop the Yuzivska shale gas field, the local community of the Donetsk and Kharkov regions has been protesting against Shell's plans to extract gas in the region. The main concern is about the risk of negative environmental impacts on those areas in case of hydraulic fracturing. In addition, according to experts from the National Ecological Centre of Ukraine shale gas extraction poses a significant danger to the "Svyatye Gory" national

park. The proposed project will also be a breach of Bern Convention on the Conservation of European Wildlife and Natural Habitats, Bonn Convention on Migratory Species, and the African-Eurasian Waterbird Agreement. Facing growing protests company officials indicated that the company is prepared to abandon the project if the public continues to be against the development of the field. In October 2015, Shell finally left the project, by declaring that at the market price level for hydrocarbons the project was not of interest for them. Nevertheless, the Minister of Energy and Coal Industry of the Ukraine Vladimir Demchishin noted that the hydrocarbon deposits development project at the Yuzovsky Field, which is carried out by the "Nadra Yuzovskaya", has not been stopped and the Ukraine will be looking for a new investor. If they fail to find such an investor until the end of 2015, the project will finally be closed.

On 19 August 2013, British police dispersed hundreds of protesters who were blocking access to an oil exploration site in rural England in an intensification of month-long standoff over the shale gas extraction industry in Britain. A total of 36 people were detained, both in the village of Balcome and in London, during the first of two days of "direct action" against hydraulic fracturing, which protesters fear may trigger small earthquakes and pollute water supplies. Hundreds of protesters converged on the West Sussex village and scuffled repeatedly with around 400 police.

In order to stimulate a U.S.-style production boom and offset decreasing North Sea oil and gas reserves, the UK government has backed hydraulic fracturing as an "energy revolution" that can create jobs and lower energy prices. British gas imports have so far mostly come from Norway and, increasingly Qatar. Last year it imported around 50 billion cubic meters of gas via pipelines and liquefied natural gas (LNG) ships. The country has potentially vast shale gas resources in underground rock formations; the government said last month there may be 1300 trillion cubic feet of gas present in the north of England alone.

Activists argue the government should invest in renewable energy rather than "fracking", as the retrieval of gas and oil from rock by injection of high-pressure water, sand and chemicals is known.

In the near future, the company Kurilgeo, which is 100 % owned by the Cyprus-based Solway Group, plans to start mining the Ainskoe gold ore deposit, located on Urup Island in the Greater Kuril Ridge, Russia, using heap leaching. Urup Island is considered to be the most important habitats of rare marine animals including sea otters, Kuril seals, and sea lions, all of which have also been listed on the Red List of endangered species. The main breeding grounds of the animals are located in the immediate vicinity to the Ainskoe deposit. Urup Island has been named a special area of key importance for the conservation of the Kuril sea otter population by the Red List of the Sakhalin region and the Red List of the Russian Federation. The Red List of the Sakhalin region has also recommended the creation of a special protected natural reservation on Urop Island. The island had been a natural reserve from 1958 until 2003, when this status was revoked. Local residents have appealed to the Prime-Minister of Russian Government Dmitry Medvedev and the Minister of Natural Resources and Environment, Sergey Donskoy, with a request to stop the proposed gold mining project and to create a specially protected natural reservation on the island.

Also, in Khakassia (the Russian Federation), local residents have been actively protesting against the planned construction of the Arshanovsky coal mine on the Beysky field. The planned annual capacity of the mine is 5 million metric tons of coal during the first phase and 10 million metric tons in the second phase. The Arshanovsky coal mine will be located 1 km from local towns and, according to residents, it will become impossible to live in its proximity due to the foreseen high concentrations of gas and dust, on the site, which a planned depth of 200 m. Under these conditions adjacent agricultural lands will be almost impossible to cultivate, which in turn might lead to the disappearance of four ancient villages populated by natives at the moment. The mining project might also significantly pollute the Abakan River, which is the source of drinking water for local cities and towns with a total population of some 300,000 people. Local residents have held a number of meetings in local villages and towns and are preparing a joint petition to the President of the Russian Federation with demands to stop development of the mine.

Often local populations protest not only against currently running exploration and mining projects, but also against proposed auctions and tenders that distribute the rights to eventually explore and develop various deposits of mineral resources (Table 6). In early July 2013, the Transbaikalian Mineral Resource Management Agency has announced the auction for the right to explore and mine alluvial gold in the basin of the Kirkun River of Kyrinsky District in the Russian Federation. A site area was 7.7 km^2 with total expected gold resources of 23 kg, and the minimum (start-up) rate of subsoil use was a one-off payment to the government of 77 thousand rubles (around U.S. 2500). Representatives of environmental organizations – the International Coalition "Rivers Without Borders" and the Amur branch of the World Wildlife Fund (WWF) – appealed to the Minister of Natural Resources and Ecology of the Russian

Federation to cancel the auction due to the high natural value of Amur river basin and include this and other areas situated in the transboundary basin of the river Onon in the Federal Fund of Reserve Subsoil Areas.

In Russia a highlight of similar protests has been confrontation of local community and local authorities in the Voronezh region in regards to the proposed development of copper-nickel deposits in the area. In 2011 the federal government decided to organize a tender to grant rights to explore and mine Elkinsky and Elansky copper and nickel deposits. Subsequently a number of protests were organized by local residents of Voronezh and surrounding areas against the exploration and development of these fields. Several social movements have been formed - such as "In Defence of Khoper" and "Green Ribbon" - including the unnamed action groups collecting signatures against the nickel project.

The population is seriously concerned with its own health and the safety of the recreational resources, unique Voronezh black soils, the purity of surface and ground waters of the river Khoper, recognized by UNESCO as the cleanest river in Europe, the Khoper Reserve with plants and animals listed in the Red Book, including the state of nature as a public domain.

However, public administration bodies in the sphere of subsoil

Table 6

Announced auctions for subsoil use rights that caused protests of population of regions of Russian Federations

Deposit/Field and Location	Action Announcement Date	Type of Mining Rights Offered	Area, Square Kilometers	Inferred Mineral Resources	One-Off Subsoil Use Payment, US$	Possible Dangers to the Environment and to Health of Local Population Caused by Mining Operation (According to Local Population and Environmental Organizations) and Claims Advanced by the Local Communities
Tsagan plot, Transbaical Territory	10 July 2013	Exploration and production of alluvial gold	7.7	23 kg	2567	Destruction of natural landscapes. Pollution of the Onon river basin Absence of socio-economic benefits for the local population in light of insignificant reserves of alluvial gold. It is proposed to cancel the auction and to include the Tsagan plot and other subsoil plots of alluvial gold in the transboundary Onon river basin in the Federal Fund of Reserve Subsoil Areas
Shapsugsky plot, Krasnodar Territory	25 June 2013	Geological survey, exploration and production of natural cement rocks	24.84	P3 -160 M MT	20,000	The destruction of forests and natural landscapes of the Skabido and Abin rivers with their feeders that are favorite recreation areas of locals and tourists near the Shapsugsky village. The area also includes historical and cultural monuments, namely three ancient dolmens in a good state of preservation, a mud volcano, and remains of ancient fortress on the Ostray mountain, as well as the famous recreational site Romashkina Polyana. It is suggested to cancel auctions and create a specially protected natural territory near the Supsugsky village
Erivansky plot, Krasnodar Territory	25 June 2013	Geological survey, exploration and production of natural cement rocks	8.38	P1 - 60 M MT	10,000	
Abinsky plot, Krasnodar Territory	25 June 2013	Geological survey, exploration and production of natural cement rocks	2.55	P3 - 40 M MT	6900	

resources believe that the possibility of profitable nickel mining in the Norilsk mining district in northern Russia is almost exhausted, and the inferred reserves of the Voronezh region in the event of positive results after exploration activities can be implemented in reserves of nickel, copper and cobalt, the largest in Europe, and the future mine will provide opportunities for jobs and development of the social sphere.

In accordance with the contest results dated 22 May 2012 the winner was the Mednogorsk Copper and Sulfur Plant – a subsidiary of the Ural Mining and Metallurgical Company. On 26 July 2012 the winner was issued the licenses for subsoil use. Geologically, the license areas are located in the Elansky and Uvarovsky mining district of the Kalach-Ertilskaya zone of the Voronezh crystalline core-area. Inferred resources of categories $P_2 + P_3$ of the Elkinsky license area amount to 993,800 tons of nickel, 33,900 tons of cobalt, 129,600 tons of copper, Elansky—54,100 tons of nickel, 5.6 tons of copper, 1.7 tons of cobalt P1 and 1,753,500 tons of nickel, 209,300 tons of copper, 53,300 tons of cobalt in category $P_2 + P_3$.

In accordance with the terms of subsoil use, exploration of these areas should be completed in May of 2020, a technical development project should be drawn up by May of 2012, the construction of infrastructure facilities of the mining enterprise should start in 2022, and in 2027 the mining enterprise should be put into service and by 2028 it should reach the design capacity.

In June 2012, in an attempt to solve the ethical dilemma using the existing legal instruments, the social organizations appealed to the regional court to obtain the right to hold a referendum on the development of copper and nickel deposits of the Voronezh Region, but the court denied the claims, explaining that these areas belong to the subsoil plots of federal importance, and the right to dispose of them belongs to the federal authorities, and is not under the joint competence. Considering that such a decision of the regional court does not take into account the other provisions of the Russian Federation Constitution, the social activists appealed to the RF Supreme Court.

On 14 September 2012 the RF Supreme Court refused to hold a referendum on the issue of the nickel deposits development in the Voronezh Region. The Court agreed with the decision of the Voronezh

Regional Court and noted that the Russian Federation has the exclusive right to use these deposits.

The next protest meeting, held on June 22nd 2013, was like a Luddite revolt*. More than a thousand protesters went to Elansky field, where the temporary settlement of geologists was situated. The protesters broke a fence surrounding the exploration site and construction trailers, and set on fire to two drilling rigs, each worth US $1,000,000.

Similar examples in other countries with the participation of different peoples and local communities indicate some real trends of increasing negative attitude of the local population toward any exploration and mining work, regardless of exploration methods, mining systems and environmental protection measures. In particular, mining activities are viewed more critically in areas where people strongly rely on ecosystem services or have suffered from negative environmental impacts before. People are always reluctant to live close to areas with a significant level of mining activities. Perceived and actual environmental impacts created by mining operations are one of the most frequent causes for the local population to oppose new projects in their region. In many places communities report a lack of financial benefits to local business in spite of massive profits for mining companies and royalties for government.

However, it cannot be denied that the population growth, social progress and the unlimited desire of the population to increase its living standards and comfort require permanent economic advancement accompanied by increasing production and consumption non-renewable mineral resources production. This is also illustrated by the world production statistics (Table 5).

Almost all the specialists in the sphere of natural resources law while analyzing the legal status of natural sites emphasize that the concepts “earth”, “mineral resources”, “water”, “forest” have a deep moral nature and cannot be anything else but the national property.

* Luddites – group of English workers, who protested against the changes, caused by industrial revolution early XIX century. Often the protests were destroying the equipment and plant. By 1811, the Luddite movement covered the entire England. The movement was followed by ruining of wool and cotton-knitting plants until the English government suppressed it severely. In 1813, destruction of equipment was announced as a death penalty crime. 17 people were executed, many sent to Australian prisons.

Without going into discussion about the problems of title to subsoil it should be noted that in most of countries subsoil, including mineral resources contained therein, energy and other resources are state property.

Therefor the mineral resource base as a state property and public domain can be described as a non-renewable natural object, the right to use which may be granted to individuals and legal entities on paid and fixed-term conditions with the obligation of the user to comply with licensing terms and conditions. In this case process of involving certain resources into exploration and mining reserves should ensure public interests of both current and future generations.

Recognition of subsoil and mineral resources as state and public property in a constitution (i.e., Germany, Greece, Spain, Italy, Norway, Russia, and Sweden) puts an obligation on the government to ensure balanced and efficient use of mineral resources to the public benefit by designing and implementing specific policies and strategies for the use and replacement of mineral resources in a country. Governments need to find cost-effective solutions to ensuring a sustainable development of mineral resource base and preservation of the environment in conditions of uneven geographical distribution of mineral deposits both in Russia and worldwide. Sustainable mining is a theoretical, but highly unlikely, possibility. The use of non-renewable resources – such as metals and minerals – can be sustainable if the use is declining, and the rate of decline is greater than the rate of depletion.

In Russia subsoil, including the subsoil domain and mineral resources contained therein, energy and other resources are state property. Issues of ownership, use and disposal of subsoil shall fall under the joint jurisdiction of the Russian Federation and the subjects of the Russian Federation. Mineral and other subsoil resources produced under license terms may have the status of federal property, the property of the Russian Federation sub-divisions, municipal, private or any other property status.

The examples of the Elkinsky and Elansky copper and nickel deposits described above fall under the jurisdiction of the federal government according to the “On subsoil” law of the Russian Federation and therefore decision to grant a mining license for these deposits as

well as responsibility for any consequences lies with the federal government as well. It is a pity in this case the federal government of Russia could not foresee such a negative reaction from local population and thereafter simply left the mining company to deal with the local community. It is also hard say if when making the decision to grant the mining license for these deposits the government had also taken into account article 9 of the Constitution of the Russian Federation ("Land and other natural resources shall be utilized and protected in the Russian Federation as the basis of life and activity of the people living in corresponding territories") and article 36 ("Possession, utilization and disposal of land and other natural resources shall be exercised by the owners freely, if it is not detrimental to the environment and does not violate the rights and lawful interests of other people").

The problem of the social (non-) acceptance of the mining industry is relatively new, but has been quite widely discussed at least since the 90s. It is noted up to the present day its focus was on three core themes of Community and Environmental Sustainability, Operational Effectiveness, and Social Responsibility of Business [131, 148]. Relations in complicated system "Abiotic nature - the state as the owner of the subsoil - the mining company" were not considered.

In the reality there is another silent participant of the conflict - abiotic nature. It is important to recognize and respect its rights (or "quasi-rights" as a correlate of legal rights), and support its "interests" in practical discourses and institutes created by man.

Any mining activities have a negative impact on natural landscapes, disturb groundwater hydraulics, contaminate soil, subsoil and underground water, reduce geodiversity (geodiversity is the natural range (diversity) of geological (bedrock), geomorphological (landform) and soil features, assemblages, systems and process. Geodiversity includes evidence for the history of the Earth (evidence of past life, ecosystems and environments) and a range of process (biological, hydrological and atmospheric) currently acting on rocks, landforms and soils and etc. The consequences of exploitation and destruction of abiotic nature is not perceived as a real threat to our existence, such as nuclear war. Firstly, the consequences are perceived to be far away in the future and secondly, mining creates illusion of a value-add ac-

tivity for the population. Therefore, the conservation of abiotic nature is by no means evident and important in the eyes of many people. As M. Grey notes the expression "Save the Dolphin" is always likely to have greater appeal to the public than "Save the Drumlin" [64].

Nevertheless, the demands to stop or prevent mining activities are obviously inadequate. There is a need to find an adequate solution that would be based on ethical principles and also take into account commercial rationale. Most countries, especially those that possess significant mineral resource bases, face a geoethical dilemma, so-called the mineral resource dilemma. In most of examples described above the state could not foresee social conflicts, and as a result the desperate local population or mining companies have to search for solutions separately. Since geoethical dilemmas only arise if one party in a conflict will incur a loss in any case, a solution to the issue will be based on the ethical grounds and involving a "lesser evil" principle.

Typically the mineral resource dilemma looks as follows:

Sooner or later companies that hold exploration or mining rights need to obtain consent (formal or informal) of the local population for exploration and mining activities in the area. Both parties have to make a decision:

a. The local community does not argue against the government decision to grant the right to explore/mine/extract mineral resources in a certain area and in 8–10 years the local budget will receive additional income, the size of which will depend on revenues and costs of the mining business, especially environmental remediation expenditures, community-related expenditures. In this case the environment and subsoil will suffer a certain degree of degradation;

b. The local community lobbies against exploration and production of mineral resources and a result the mining license is revoked by the government or forfeited be the mining company. In this case the local budget will obtain no additional revenue and no environmental damages will be suffered. Alternatively instead of forfeiting the license, the mining company can decide to substantially increase its environmental remediation expenditure (to the satisfaction of the local community) in which case the

environmental and community related damages are minimized as well as the additional revenues of the local budget (Table 7).

Table 7

Matrix of possible solution to the mineral resource dilemma and their consequences

Feasible Solutions	Consequences			
	Local Community against the Proposed Mining Activity		The Local Community is Indifferent to the Proposed Mining Activity	
Mining business does not take into account protests or social needs of the local community	Alternative # 1	Mining company has to cancel the project completely and suffers a direct loss	Alternative # 2	Mining company obtains a maximum mining profit
		Environment and abiotic nature completely preserved		Environmental and subsoil degradation
		Local budget does not receive any mining revenues		Maximum mining revenues to the local budget
Mining business incurs substantial additional environmental remediation costs and community oriented expenses	Alternative # 3	Minimal profit for mining business due to maximized environmental expenditures	Alternative # 4	due to obligatory environmental remediation and community related expenses
		Minimal damage to the environment and abiotic nature		Limited damage to the environment and abiotic nature
		Moderate local budget revenues		Moderate local budget revenues

A solution to the dilemma is determined to a certain extent by the goals and interaction strategies of parties involved. If each party is only considered its own goals (profits maximization of a company or nature preservation at any cost), alternative # 1 will be the best for the local community and alternative # 2 for the mining company. But from a joint point of view, if the mining company and the local community are aware of limited uneven geographical distribution of mineral resources, growing consumption of mineral resources by society and need for economic development, while preserving (to the extent pos-

sible) the environment from the negative effects of mining, it would be the best to act together using alternative # 3 and # 4. In this case, the solution to the dilemma will be found depending on, firstly, demands of the local community, secondly, on the amount of environmental and social oriented expenditures that the mining business is prepared to bear.

At the same time any dilemma participants cannot be sure that the other side will meet its obligations during the agreed mining period. If the mining rights are revoked by authorities for certain reasons or in case of mining company deciding to forfeit the rights, any legal or moral obligations of the mining company regarding the environment or local community will fall away. Also there is no guarantee that the requirements of the local population will not change in the future.

The matrix above (Table 7) shows the final solution to the mineral resource dilemma. However, the origin of the mineral resources dilemmas and its consequences (protests of the local communities, economic losses of business, damage to the environment, and others) are determined, primarily, by the decision of the state to conduct a geological survey, and organize exploration and production of the subsoil plots. From the geoethical point of view such decisions should be made based on the geoethical imperative of sustainable development being determined within the tripartite system of abiotic nature, man and society [119]. In which case it is important to ensure:

- the human right to a healthy and productive life in harmony with nature;
- equal opportunities for the development and preservation of abiotic nature for present and future generations, including mineral resources, useful properties of subsoil, landscapes etc.;
- socio-economic development aimed at improving the quality of human existence within limits of the economic capacity of geological systems and sites;
- elimination of causes of negative mining impact and not is consequences;
- development of geoethical consciousness and mind set as well as geoethical education system.

In practice, this means that the process of distribution mining

rights should be preceded by establishing programmes of sustainable development and replenishment of mineral resources that are based on current and forecasted consumption and production levels and available information about possible decrease/increase of mineral resource base. These programmes should also take into account the needs and objectives of the government as well as of local communities. Before any mining rights are given to any company it is important to address of the concerns of local population that are listed below:

- Is the development of the particular mineral deposit really necessary for the economy?
- What short-term and long-term benefits will be received by the federal and local governments on case of mine development?
- What possible dangers and threats to public health and living conditions can arise as a result of the mining activity?
- What objects, components, elements, systems of the environment will be lost forever or will undergo degradation in case of mine development?
- What is the balance between the economic benefits from mining to the state and population and caused negative environmental impact?
- What specific activities are planned for the remediation, rehabilitation and restoration of land areas and other natural features damaged in the course of the mining activity on the site? What is the timeline and certainty of these activities being implemented?

Another important issue to be considered is the fair distribution of the benefits from mining. The federal law – On the Federal budget for 2013 and the planning period of 2014-2015 – provides for the following guidance on the income distribution from mineral resources exploration and production (Table 8).

Table 8

Guidance on income distribution from the mineral resources exploration and production between the various budgets of the Russian Federation for 2013 and the planning period of 2014 and 2015 (%)

Item of Income	Federal Budget	Budgets of Constituent Entities of the Russian Federation
One-off subsoil use payments in the case of onset of certain events stipulated by a license (except for subsoil plots containing deposits of diamonds, and local-significance deposits of mineral resources)	100	-
One-off subsoil use payments in the case of onset of certain events stipulated by a license for use of local-significance subsoil plots	-	100
Mineral resource recovery tax (combustible natural gas)	100	-
Mineral resource recovery tax for hydrocarbon raw materials (except for combustible natural gas)	100	-
Mineral resource recovery tax (except hydrocarbon raw materials, natural diamonds and commonly occurring mineral resources)	40	60
Mineral resource recovery tax for commonly occurring mineral resources	-	100
Mineral resource recovery tax for natural diamonds	-	100
Regular subsoil use payments	40	60

As shown in Table 8, most of the income from the distribution of the mining rights at the initial stage flows into the federal budget, including one-off subsoil use payments in the case of onset of certain events stipulated by a license (except for subsoil plots containing deposits of diamonds, and local-significance deposits of mineral resources). Budgets of constituent entities of the Russian Federation

would only be entitled to regular subsoil use payments during geological survey and exploration (60 % of the regular payments that are very low and to a share of mineral resources recovery tax, in production phase 60 % of the mineral resource recovery tax for solid minerals and 100 % in case of commonly occurring mineral resources). The issue is that the initial one-off subsoil use payments are made to the federal budget at the time of the auction process while the payments to the local budget only start flowing in during the production phase which is usually 7-10 years later that the initial auction. In the meantime local population can already be faced with negative consequences from the mining operation including destruction of the environment overall and the abiotic nature in particular in the course of the exploration, construction of infrastructure and mining. Such imbalance in the distribution of the revenues between the federal budget, budgets of constituent entities of the Russian Federation and local budgets causes significant concerns to the local population and can further impact the relationship between the local community, mining companies and local government.

This imbalance leaves the local population asking the following questions: who is the ultimate shareholder(s) of the mining company and where has the company been domiciled? First of all, the answers are strictly confidential. Secondly, in the event when the mining company is registered overseas, the governing body will have to consider whether the deposit in question has a status of "federal importance" which in turn puts certain restrictions on non-Russia domiciled companies being able to operate it. Thirdly, it should be noted that most of the mining companies operate in Russia at the moment are domiciled overseas with the exception of "ALROSA". Overseas domiciliation is primarily used to fond and obtains cheap loans, without which it is impossible to develop mining projects in Russia, and in order to avoid a hostile takeover. However, regardless of domiciliation specific subsoil use payments and the mineral resource recovery tax flow to the budgets of the Russian Federation in any event. In this situation, the government needs to foster a business environment in which companies can maintain and develop their business and also provide support and care to the abiotic nature and local population.

On the other hand a mining company that intends to apply for a mining license for a particular deposit and plans to operate in a certain area, needs to have a common strategy of conflict prevention, including situation analysis, stakeholder engagement and integrated impact assessment. To ensure economic feasibility, profitability and continuity with respect to mining activities, the business needs to engage and secure "approval" of local community.

There are now many successful big and small corporations (CJSC Petropavlovsk Managing Company, Kinross Gold Corporation, etc.) working hand in hand with local communities, environmentalists, civil society groups and governments. Their purpose is not only the profit from mining, but also to improve quality of life of local population, to support local townships, to provide alternative job placement after closing of mining projects and to restore land areas and other natural features damaged by mining activities to a condition suitable for further use, while conserving the environment and preserving cultural heritage.

It is essential recognize that the need for a healthy environment is a basic need what if using Maslow's hierarchy comes after safety needs (protection from elements, security, order, law, limits, stability, freedom from fear) and is followed by social needs (belongingness, affection and love) of a human being:

1. In order to avoid conflicts with the public and local populations during mining activities, the government should only allocate the mining rights after thorough analysis of forecasted levels of production and consumption of the mineral resource, detailed review of possible economic and social development of a particular region, understanding specific goals and objectives of the government and the local population that will be achieved a result of a mining project and analysis of possible social and environmental risks.
2. Distribution of mineral resources revenues between budgets should be transparent and equitable, so that local population is appropriately compensated for environmental degradation, decline of bio- and geodiversity, and deterioration of population health.

CHAPTER 5

GEODIVERSITY AND NEED FOR ITS PRESERVATION

In the ordinary sense the diversity is the existence of disparate, non-recurring items and a lack of uniformity.

W. Ashby defines the diversity through multiplicity of possibilities or different classes of objects and probability that some element belongs to an appropriate class thus connecting the view of diversity with the information theory [11], but R. Margaleff defines the diversity just like a measure of information. W. Ashby in his famous work “Introduction to Cybernetics” formulated common view of “law of indispensable diversity” for bounded systems, which defines the functional role of diversity in regulatory and management system.

In the ordinary sense the diversity is the existence of disparate, non-recurring items and a lack of uniformity.

Natural diversity is a fundamental feature of Nature. It reflects the set of structural and functional characteristics of the natural organization that has been implemented during evolution. It currently ensures sustainable development of planetary life, of the biospheres and geospheres, and it supports ecological balance and eco¬logical stability, while at the same time allowing the development of the true potential of Nature. In science, there are several points of view of the concept of 'natural diversity': sometimes, it is treated as being synonymous with biological diversity, sometimes as a combination of all species of animals, plants and microorganisms, and of all ecosystems, and their place in ecological processes. Accordingly, there are three levels of biodiversity:

- genetic diversity (the amount of genetic information contained in the genes of all species of plants, animals and microorganisms);
- species diversity (the number of species);
- ecosystem diversity (the number of different habitats, biotic communities, and ecological processes).

In biology, diversity is associated with the funda¬mental features of life and its organization, while its proliferation in geosciences originally had a purely pragmatic aspect of preserving natural values. Geodiversity and the concept of its preservation are new definitions for most people. The concept that the physical features of the Earth (rocks, subsoil, mineral resources) need good management and preservation is not obvious for the majority, as the structures on the surface of Earth and within its subsoil look strong, solid and stable.

5.1 GEODIVERSITY

In the past 15 years, the problems of preservation and use of the geological environment has prompted the formation of geodiversity and landscape diversity concepts.

In the modern sense, the term 'geodiversity' was first used in Tasmania, shortly after the adoption of the Biodiversity Convention at the International Summit in Rio de Janeiro in 1992. However, before 1992, geoscientists used terms such as the “diversity of the Earth", and “geomor- phological diversity". It was a direct consequence of the parallelization with biodiversity and use of terms such as “landscape species” and “landscape community” in biodiversity theory. Thus, in the early 1990s when biodiversity became an accomplished event, Tasmanian geologists quickly adapted it for the geological equivalent geodiversity, to describe the variety within abiotic Nature [12-14]. The basic definitions of geodiversity are given in Table 9.

All definitions above derive from the variety of rocks and minerals, the form of relief, soil and subsoil, and also from geological processes, or from the inextricable connection between geological formations, systems, processes and people, associated with our natural heritage such as bio- and geodiversity, our cultural landscapes, and more.

Table 9

Definitions of geodiversity

Year	Author of the definition	Definitions
2004	Murray Gray	The natural range (diversity) of geological (rocks, minerals, fossils), geomorphological (landform, processes) and soil features. It includes their assemblages, relationships, properties, interpretations and systems [64].
2004	David Roche	The variety of rocks, minerals, landforms etc., and the processes that have formed these features through geological time.
2002	Collin Prosser	The variety of rocks, fossils and minerals and natural processes [145].
2002	Mick Stanley	The link between people, landscape and culture; the variety of geological environments, phenomena and processes that make those landscapes, rocks, minerals, fossils and soils that provide the framework for the processes of life on Earth [163].
1997	Rolan Eberhard	The natural range (diversity) of geological (bedrock), geomorphological (landform) and soil features, assemblages, systems and processes. Geodiversity includes evidence for the history of the Earth (evidence of past life, ecosystems and environments), and a range of processes (biological, hydrological and atmospheric) that are currently acting on rocks, landforms and soils [44].
1995	Chris Sharpless	The natural range (or diversity) of geological (bedrock), geomorphological (landform) and soil features, assemblages, systems and processes [159]

Note these defining characteristics of geodiversity. Firstly, it implies endogenous geological processes as well as exogenous. Endogenous geological processes are generally caused by inner powers of the Earth and they take place mainly inside the Earth. They are determined by the energy, emitted with the development of the Earth

matter, by gravity action and actions caused by the Earth rotation (tectonic, magmatic, metamorphic, hydrothermal processes). Exogenous processes are generally caused by external powers. They take place on the surface and on the top level of lithosphere and determined by gravity action, solar radiation, climate, organisms' activity (erosion, movements of the erosion products under the gravity action and with the water, ice-caps, wind power. Endogenous and exogenous geological processes are strongly connected. Many geological phenomena, material formations (ex. Oil, coal, soils), structural forms of relief appear as a result of interreaction of these processes. Affected by this strong connection of endogenous and exogenous processes, by processes of enlargement of the range of ethic relations objects and with the identification of needs for ethic self-regulation ozon screen and planet climate referred to the objects of ethic relations.

Secondly, the definition implicidly includes past and present geological time and space. However, all of these definitions have one disadvantage. They do not include the different levels of geological systems [89], and the complex interactions between these geological systems that do not involve the use of different scales, from global (continents and oceans) to elemental (atoms and ions).

Geodiversity is defined by fundamental characteristic of insentient substance to enter into reactions under the pressure and temperature variation. Geodiversity is created as a result of independently parallel or sequential actions of endogenous and exogenous processes, which lead to constant taxonomic differentiation of geologic objects and systems at all levels.

Also note the differentiation of key definitions of geodiversity:

- geodiversity is a *main characteristic* of inanimate nature, which we try to preserve;
- geodiversity is not the same as geoconservation, although the terms are sometimes used synonymously;
- preservation of geodiversity is a *process* of conservation;
- geological heritage (geological nature landmarks) is concrete, specially identified geological *objects* , that need to be preserved or which are already subjected to preservation.

Endogenous and exogenous geological processes have a leading

role in the formation, preservation and destruction of the variety of subsoils, surfaces and landscapes of the Earth because of their great power and duration, which is not comparable with the duration of the existence of the human species.. But for the last 50 years the formation of geodiversity has been strongly affected by anthropogenous and technogeneous processes. Now the human impacts on the Earth as a geological body are only related to the lithosphere, which they affect in terms of the following basic activities:

- geological surveys and exploration (carried out without any material surface integrity);
- mining;
- construction and maintenance of underground facilities unrelated to mineral production;
- formation of lithospheric technical zones under territories of cities and industrial developments;
- dumping of household and industrial wastes, including radioactive and toxic wastes;
- lithospheric (geological) weapons that use catastrophic geological processes (earthquakes, volcanic eruptions, large-scale rock falls and landslides) as adverse factors.

At the present time, no questions have been raised about the possible limits of this damage, and about the resistance of the lithosphere, and the other geological spheres, to this damage.

The creative human activities in the sphere of subsoil use are not so great. These are limited to the special protection of geological features of scientific, cultural, aesthetic, health and recreational values (scientific and training grounds, geological reserves, wildlife and geological sanctuaries, natural monuments, caves and other underground areas).

Geodiversity is a main nature component putting a great influence on the formation of its atmosphere, hydrosphere, relief, climate, appearance and development of biological life and even ethnogenesis, economy and culture. Now geodiversity is a necessary factor of sustainable development of geological systems at any level.

5.2 VALUING GEODIVERSITY

Why is it important to conserve and manage the geodiversity of the planet? Several authors have tried to outline the value of nature or the rationale for nature conservation, in general or earth science conservation, in particular. D. Wilson [177] recognized two main types of value in the earth's physical resources. Firstly, the economic value in exploiting the physical resources of the planet, and secondly the cultural or heritage value in protecting the aesthetic and research resource of the physical environment.

This twofold division is a useful one, but other writers have expanded the classification into four groups [41]:

- intrinsic value;
- cultural and aesthetic value;
- economic value;
- functional value;
- research and educational value;
- information value.

Intrinsic value refers to the ethical belief that some things (in this case the geodiversity of nature) are of value simply for what they are rather than what they can be used for by humans (utilitarian value). This is the most difficult value to describe since it involves ethical and philosophical dimensions of the relationships between society and nature. These have been discussed by a wide range of authors, and W. Beckerman and J. Pasek refer to the issue as "one of the most recalcitrant problems of environmental ethics" [21]. Some have argued that there is no such thing as intrinsic value since the value of nature depends on whichever ethical or belief system that we adopt. Other philosophers argue that nature is not a social construction but has a value in itself and this is not dependent on any uses of nature that humans might adopt [127].

One view is that the resources of the planet should be freely available for human exploitation and there should be no curbs or restrictions on the use of these physical or biological resources. This "technocentric" or "anthropocentric" view of the human place in the environment is one that demonstrates a "lack of concern for anything

nonhuman: ‘nature’ is seen as an ‘external’ environment with no worth or value, except its ability to be manipulated or exploited by society” [137].

Another line of argument for intrinsic or existence value relates to natural and human timescales. J. Bronowski with usual eloquence, described how “The hidden forces within the earth have buckled the strata, and lifted and shifted the land masses. And on the surface, the erosion of snow and rain and storm, of stream and ocean, of sun and wind, have carved out a natural architecture”. Rocks, deposits, geological formations, land forms, geological processes and sites have taken thousands of millions of years to evolve, yet can be destroyed or altered within days. Given the potential of this asymmetric cycle of creation and destruction, it is arguable that if we understand the lengths of time and complexity of the processes involved, we may conclude that the end result has some intrinsic value.

A. Leopold (1949) was one of the first to argue the case for wilderness, natural landscapes and natural sedimentary systems to be protected in their own right, and this argument plays an important role in the justification for conservation of Norwegian rivers [90].

But questions can be asked to geodiversity. Is geological diversity always beneficial? The answer must be “no”. For example, to the civil engineer the endless variety of rocks, sediments, slopes and drainage courses makes life exceedingly difficult and raises the cost of building projects through the need for site investigations, material testing and geomorphological mapping. Projects would be much simpler and cheaper to complete if there was greater uniformity and predictability of rocks, sediments, landforms and processes.

Hazards such as earthquakes, tsunamis, volcanic eruptions, floods, avalanches and landslides kill thousands of people every year and damage property. Should we conserve such damaging processes or try to eradicate them? By and large, human society, perfectly understandably, tries to prevent these hazards and disasters by various means including sensible planning, predicting events, evacuating populations, engineering solutions, and so on. But we also take a morbid interest in the spectacular dynamics of earth processes, the power involved and the threats they pose, as long as we personally are not

affected. It would be unfortunate if all potentially hazardous processes were eradicated from the planet since they are part of its natural evolution.

Several other questions need to be asked about the aims and principles of geodiversity. For example, since erosion is a natural process, should we be concerned if it removes an element of geodiversity? Do we need to preserve all the world's geodiversity even if we could identify it? If not, how do we decide what is sufficiently significant to conserve? How should priorities be identified and what resources should be allocated to conserving geodiversity relative to biodiversity? If we accept the premise that diversity can only have a subjective intrinsic value, then it also allows us to support the proposal for a distinction to be made between "geodiversity" as a value-free quality, and "geoheritage" as those elements of geodiversity that are seen as significant according to particular subjective values [64].

The cultural value of geodiversity is certainly related to the last category, but has a more practical element. By cultural value we mean the value placed by society on some aspect of the physical environment by reason of its social or community significance. It is not difficult to find examples of these attachments in both past and present societies, and because the physical environment is valued in this way, it is appropriate to conserve the landscapes and features involved.

The aesthetic value of geodiversity is a rather more tangible concept. It refers quite simply to the visual appeal (and those of other senses) provided by the physical environment. This may be through landforms at all scales from mountain ranges to local ponds, from coastlines to river banks, but all have value because of the diversity of topography they provide for residents or travelers.

Economists have attempted to put a financial value on all environmental assets, but many geological materials have more than a theoretical economic value. Rock, minerals, sediment, soil and even fossils, all have economic value, though this varies depending on the nature of the material involved. In May 2016, Sotheby's in London announced that the Lesedi La Rona, formerly known as Karowe AK6, a 1,111-carat diamond would be offered in a stand-alone auction on 29 June 2016. It was expected to sell for around $70 million. On the

other hand, a tonne of gravel may be worth only a few dollars.

The usual classification of economic mineral resources is into mineral fuels (e.g. petroleum and coal), industrial, metallic and precious minerals (e.g. metal ores and gemstones) and construction minerals (e.g. sand and building stone), but the economic value of the abiotic environment should also include fossils, other forms of energy and indeed soil and landscape resources. The distinction is also blurred in that most single mineral rocks like limestone, chalk, gypsum and silica sand have both constructional and industrial uses. The diversity of these resources has been exploited with ingenuity over the centuries and has given societies the huge range of materials they have needed to progress to their modern sophistication.

Functional value has rarely been discussed in nature conservation, but it is clear that soils, sediments, landforms and rocks all have a functional role in environmental systems, both physical and biological. In turn, we can recognise two sub-divisions of functional values. First, there are utilitarian values to human society of geodiversity in situ, as opposed to the extracted value described above. Secondly, geodiversity has a functional value in providing the essential substrates, habitats and abiotic processes, which maintain physical and ecological systems at the Earth's surface and thus underpin biodiversity.

Coastlines and streams, bogs and moors, deserts and mountains, glaciers and volcanoes: the infinite variety of life on earth is adapted to its physical environment and these diverse physical systems therefore have a functional value for biological systems and biodiversity. It is now fairly clear as a generality that areas of high geodiversity lead to high biodiversity, though the reverse is not always the case.

Research and education value provides the process of scientific cognition of the world, and is the basis for the monitoring of natural processes, including dangerous geological process, such as earthquakes, floods, landslides. By studying the dynamics of natural systems it may be possible to predict how land subsoil processes will operate in the future, frequency and magnitude of natural hazards.

The study of the geological record has enabled geologists to reconstruct in considerable detail the history of the Earth over the last 4,600 Ma. It is a record of amazing complexity and a tribute to the me-

ticulous work of thousands of geologists over a long period of time. It has been deciphered from rock outcrops and boreholes in all countries of the world and it continues to be refined by further research. Major discoveries are still being made, particularly in the less well studied parts of the planet, but even where intensive studies have been made, the geological record needs to be conserved for future study using new techniques and approaches and to allow findings to be checked and reinterpreted. This geological rock record therefore has enormous research value.

The record of sediments in lakes, bogs and ice cores also provides records of the effects of human activities on the environment through pollution, vegetation clearance, soil erosion, and so on. These records are valuable not only in reconstructing the past human impacts on the environment and the history of human use of the land but also in assessing the effects of current and potential future impacts.

In addition to these six types of values of geodiversity, there is one more: the information value of abiotic Nature, by analogy with the genetic diversity of species. Each geological object has its own unique geological information, and the complexity of this information is directly dependent on the hierarchical level of the geological object. At the present stage, only a small part of this information is available to our surveying and understanding.

Every year, tens of thousands of long-term geological carriers are withdrawn from the geological environment. As a result, the geologically complex hierarchy objects, sophisticated geological systems and accompanying processes are deprived of their future (mineral deposits, ore formations). New mechanisms for stabilizing the crustal processes are originated, which lead to activation of deep faults. This withdrawal of complex hierarchical objects and sophisticated geological systems from the lithosphere without explaining their relevance to the geological and geophysical evolution of the Earth can be potentially considered as a start of planetary disorganization.

5.3 ETHICAL PRINCIPLES FOR GEODIVERSITY PRESERVATION

Apart from the introduction of the term geodiversity into the geosciences, the major theoretical achievements of “the geodiversity doctrine” are:

1. The six core principles of sustainable development and use of mineral resources [64] are similar to the principles of “deep ecology” that were suggested by Norwegian philosopher Alexander Naess in 1974 [107, 108]: accept that natural change is inevitable, work with the natural functions and processes, manage natural systems within the limits of their capacity, manage natural systems in a spatially integrated manner, use non-re-newable Earth resources wisely and sparingly and at a rate that does not restrict future options. Use renewable resources within their regeneration capacity;
2. Classification of value types of geodiversity and creation of the concept of 'Nature and geological heritage';
3. Develop a rationale for objective necessity to maintain geodiversity because of the responsibility of living generations to future generations, and recognize the hard benefit of sustainable development of natural resources to mankind and to the natural world;
4. Action-oriented recommendations for geodiversity conservation and practical realization.

In general, the geodiversity doctrine is a significant achievement in geosciences. However, due to the insufficient development of the ethical foundations of this doc¬trine, we can see contradictions between its basic elements.

For example, the recognition of the internal (intrinsic) value of abiotic Nature essentially means that people do not have the right to reduce the geodiversity; in other words, people do not have the right to exploit objects that are abiotic in nature, or to interfer in the organization processes that occur in abiotic Nature. In this case, any proposed options for preservation of geodiversity will constantly lose competition to the mining industry, because revenues from this sector are obvious and tangible. The proposed principles for the preservation

of geodiversity do not contain any indications of the boundaries of the right to exist. What geological features, objects, systems, processes and phenomena “have value simply because they exist"? How does this relate to the objective necessity for human use of mineral resources for the maintenance of the existing human civilization? Should we stop the spread of geological processes that are dangerous for us?

In developing the ethical principles of geodiversity preservation, I have tried to rely not on an abstraction of the universal validity of moral norms, but on their potential realizability. The proposed variant of ethical principles of geodiversity preservation is not an only one. It may be complemented and enlarged.

1. Being a part of Nature, people should not re-organize geological systems, particularly on a global and regional scale. It is permissible to interfere with natural geologic processes on a local level in cases where they are a threat to human life.
2. People have no right to reduce geodiversity, except to meet basic needs.
3. Recognition of the need to establish effective limits of consumption and use of mineral resources, as components of the geological environment, on the basis of stabilization of the world population; to substitute the linear degradation of mineral resources using renewable resources and the recycling of mining wastes.
4. Opposition to an unregulated market economy, especially if it is a mineral-resources-based economy.
5. The use of mineral resources, and of objects and components of the geological environment should be based on the recognition of the objective laws of development and interactions between the geospheres and society, on the modern scientific and technological achievements, on the combination of possibilities of geospheres, and on the economic interests of society, providing real guarantees for the rights of citizens to benefit from the use of the subsoil (scientific principle).
6. Policies, strategies and tactics of geological heritage preservation should be formed as a complex interactive system of institutions and individuals: governments, public and social or-

ganizations, on the global, national and regional levels; geoscientists, geoexperts, and 'geological heritage consumers' (visitors to geoparks and geological museums, tourists).

7. In the 'man-and-abiotic-nature' system, the whole takes precedence over the singular, such that if the use of a geological object does not to lead to a decrease in the geodiversity of higher geosystems, then that object can be used).

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Thus, in contrast to the concept of biodiversity, the term geodiversity, its value, and the need for its conservation, has not yet entered the broad academic community.

However, it is clear that in addition to biodiversity conservation, geodiversity (and in the future, the variety of animate and inanimate Nature) should also be a priority in any human activity on Earth. It is characteristic of the geological diversity, and ethical guidelines for its conservation should serve as a basis for policy, as we aspire to manage our mineral resources to ensure sustainable economic development.

CHAPTER 6

ETHICAL PROBLEMS DURING EXPLORATION OF MINERAL RESOURCES ON EXTRA-TERRESTRIAL OBJECTS

6.1 PROSPECTS OF CARRYING OUT EXPLORATION PROJECTS ON NATURAL CELESTIAL BODIES

Technical progress has been developing in a way that soon natural resources of our solar system will be available for exploration.

Natural resources of celestial bodies is a tangible, material part of their structure that possesses the qualities incredibly useful for humanity.

Currently the most valuable space resource is Geostationary Earth Orbit (GEO). There are geostationary satellites at 35 786 km above the earth remaining permanently fixed in the orbit which is very important for the companies providing communication services. Access to the GEO is regulated by the International Telecommunication Union. There are more than 390 “live” satellites in the orbit and many more “dead” ones.

The most promising project amongst the ones dedicated to exploration of mineral resources on extra-terrestrial objects is exploration of Helium-3 on the Moon as an alternative energy source. The importance of this project is highlighted by enormous costs of 1kg of raw material needed to produce energy and the opportunity to maximise production of energy from raw materials directly on the Moon.

It is known that by thermonuclear reaction of 1 tonne of Helium-3 and 0.67 tonne of heavy hydrogen, release of energy is equivalent to burning 20 millions of tons of crude oil or about 10GW of energy. About 200 tons of Helium-3 is needed per year to provide energy to the world human population at the current rate of annual energy consumption. Besides, the energy produced is eco-friendly, green energy. Thermonuclear reactions based on Helium-3 release protons rather than neutrons and are almost non-radioactive, which makes facilities for such reactions safe in case there are natural disasters such as earthquakes, eruptions, or tsunami or terrorists’ attacks.

On our planet Earth, however, natural Helium-3 usually exists as an isotope of Helium-4 (abundance of 99,99986 %) whereas abundance of Helium-3 is just 0,00014 %. Annual total capacity of Helium-3 is equal just tens of grams.

Moon's surface contains about 10mg/tonne of Helium-3. If the average lunar soil (regolith) thickness is about 3 meters, reserves of Helium-3 are more than a million tonne. With such deposits in order to extract 1 tonne of Helium-3, you will need to extract and process about 1 bn tonnes of Moon's soil, which is quite comparable to the volume of earth soils currently processed by the our mining industry.

As a matter of comparison: as per BP Statistical Review of World Energy, annual extraction of coal of all types in the world within the last 3 years was 7.7-8 bn tonnes. The scale of work is enormous. Tech-

nical and economical solutions that we have nowadays are based on the characteristics of regolith that have not been studied in depth yet. Whereas the concentration of Helium-3 in the atmospheres of Jupiter, Saturn, Uranus, and Neptune is thousands of times higher. Relatively low gravitation of Uranus and Neptune can help make an orbital station focused on Helium-3 enrichment economically profitable.

Thus, execution of the project that will provide humanity with an alternative energy source for thousands of years is only possible through finding a solution for controlled thermonuclear reaction of Helium-3, achieving positive results of geological exploration projects in space and creating infrastructure that will help explore indicated natural reserves of the moon. In all these cases there are no principal physical limits, however the objectives are very hard to reach from a technical point of view.

According to the extended technical-economic profitability study of extracting Helium-3 on the moon, conducted by the researchers from IEEC (IMC Montan group), if annual extraction of regolith is 1348,11 tonnes and extraction of Helium-3 from that regolith is 17,52 kg/annum, equivalent to about 3 066 000 thousand KW/h energy per annum – pay-off period for such project will be just 9 years [172]. Energy unit price used is slightly inflated ($0.15 KW/h), a lower discount rate of 5 is applied, and the only capital expenditures that are taken into account are the costs of building a special thermonuclear station on Earth (it is assumed that larger investments required to build a plant and other infrastructure objects for exploration on the moon will be a part of general space programs carried out by the governments of various countries). Such calculations indicate that mining natural resources on the moon is no longer an economic or technical phantasy, but can actually become an area for finding a practical and realistic alternative energy source.

Apart from Helium-3, another resource that can be used as propellant is ice water, exploration of which seems economically viable. Deposits of ice water can be discovered in Shackleton crater close to the south pole of the Moon. Its diameter is 19 km and its floor always stays in a shadow. With the temperatures -240 °C it is one of the coldest environments in our solar system. As suggested by the Shackleton

Energy Company (Texas, USA) in order to create reserves of propellant in the near earth orbit, the mined object will have to be heated just a little to melt the ice into water and to break the water into hydrogen and oxygen – fuel and oxidizer for propellants [23].

During successful Cassini–Huygens mission, in particular the analysis of the images of Titan, Saturn's moon, has shown that Saturn's surface contains large deposits of hydrocarbons (methane and ethane) that form lakes.

There are theoretical assumptions that Mercury's subsoils contain nickel, cobalt, copper, platinoids, gold, uranium, thorium as well as Helium-3.

In October 2015, Curiousity – a robotic rover exploring Gale Crater on Mars has drilled the 8th hole (65mm deep) and has taken images of mountains rich of iron (according to NASA).

Further exploration of space by mankind also suggests mining and resource development on asteroids. The whole idea of asteroid mining is older than any space mission. Even in 1903 the pioneer of astronautic theory and rocket scientist Konstantin Tsiolkovsky included asteroid mining as one of 14 most important purposes of space exploration. Asteroids may have more variety of natural resources than the moon and also contain such useful components as platinum group metals, gallium, germanium, selenium and tellurium. Relatively small force of gravity on asteroids minimises fuel use by take-off and landing.

M-type asteroids are made of metals, mainly of nickel and iron. Asteroid (6178) 1986 DA is one of the smallest asteroids of this type which is getting closer to the earth. It size is 2.3 km and it contains 10bn tonnes of iron, 1bn tonnes of nickel, 10,000 tonne of gold and 100,000 tonne of platinum.

Stone-type asteroids, called Chondrites, can be classified in several types. LL-Chondrites contain little iron, however meteorite samples show more than 50g/tonne concentration of platinum group metals which is a lot higher in comparison to most ore minerals on Earth.

C-type asteroids (75% of all known small planets) are very dark, carbon-containing bodies. Figuratively they are called artesian wells of the solar system. Although they contain less metals they are rich in

ice water, hydrated minerals and fuel-volatiles. However due to the distance from Earth, main issues when mining on asteroids are communication, automatization and resistance of equipment.

There are non-state companies in the US such as Planetary Resources (since 2012) and Deep Space Industries (since 2013) that are working on projects aimed at creating low cost space vehicles to explore and mine mineral resources on asteroids.

There are 3 types of projects that have been developed to mine and process natural resources on asteroids:

1. Mining and processing of natural resources on an asteroid, delivery to Earth of only end products that can be industrially used without any further technological operations or process
2. Mining of natural resources on an asteroid with further processing on Earth
3. Transportation to Earth or the Moon of small asteroids for mining and processing

Practical realisation of type 1 projects is not very likely in the near future because in order to run such technological cycle either physical presence of people needed on an asteroid, or the highest level of process automatization as well as huge amounts of energy. Type 2 projects are highly unlikely to be economically efficient. Type 3 projects have been closely studied by the experts from Keck Institute for Space Studies (KISS)*. According to their published findings, the mission is possible with current scientific and technical knowledge and abilities. The costs of a mission to deliver an asteroid to Earth are estimated at around $2.6 bn.**

In the Russian Federation, there are the following documents covering exploration of space and other planets:

1. Fundamental principles of the Russian Federation State polices in the field of space activity for the period until 2030 and onwards, approved and signed by the President of the Russian Fed-

* Keck Institute for Space Studies (KISS) – is a joint institute of the California Institute of Technology and the Jet Propulsion Laboratory established in January 2008 with a $24 million grant from the W. M. Keck Foundation. It is a privately funded think tank focused on space mission concepts and technology.

** Leone D. Lightfoot Pins $ 1.25 Billion Estimate on Asteroid Mission's Robotic Capture. http://www.spacenews.com/article/civil-space/40005lightfoot-pins-125-billion-estimate-on-asteroid-mission%E2%80%99s-robotic-capture

eration on 19.04.2013

2. Principals of the Russian Federation policies in the field of using the results of space activity for modernisation of Russian economy and regional development for the period until 2030
3. Draft Federal Space Program of Russia for the period 2016-2025 (FSP)

Main state interests of the Russian Federation in the area of space activity cover exploration of the Moon, Mars, other celestial bodies, as well as study and utilisation of non-Earth resources. About 1.5 trn roubles have been allocated in the budget of Russian Federation for space exploration activities until 2025. The following stages are envisaged:

2025 – Piloted flight around the Moon,

2030 – landing on the Moon,

2030-2040 (long term objective, currently not part of FSP) – an expedition to a region where potential testing area can be located and establishing the first infrastructure objects for exploration and mining of natural resources from Moon's soils.

Currently there are 10 countries that already have technical capabilities allowing them to access and explore the Space. Their plans are as ambitions as the plans of the Russian Federation.

For example European Space Agency (ESA) in July 2014 has finished tests of sub-orbital reusable space plane. In 2016 ESA together with The Russian Federal Space Agency (RFSA) are planning to send an orbiter to explore Mars, and in 2018 to land a module on its surface – Mars Rover Vehicle. In 2020 it is planned to land a rover vehicle on the Moon's South Pole.

China is planning to build its first orbital station on the lunar orbit by 2020, and by 2030 to start construction of a lunar base.

In 2018 Dutch non-state company Mars One is planning to send a test module and in 2020 a space ship with people to Mars.

Japan and India are also working on their own space programs. Japanese space rover Hayabusa-2 was launched in 2014. It is expected to reach asteroid Ryuga in 2018, and in 2020 to bring its soil samples back to Earth. Scientists believe that this asteroid contains many hydrous minerals. This asteroid is classified as type C and in its chemical composition is close to nebula that has created the Sun. Soil samples

from this asteroid may help in studies of our solar system origins and development and origins of life.

Long term objective of space programs by all countries is exploration of natural resources on celestial bodies and their use in economies on Earth.

6.2 LEGAL ASPECTS DURING EXPLORATION OF NON-EARTH NATURAL RESOURCES

Exploration of mineral resources on celestial bodies may not be such a distant future anymore and there is clearly a need to develop a concept of ownership of natural resources mined on other planets as well as ethical norms and rules of their use.

Not so long ago it seemed that fundamentals of such concept based on very high ethical principles have already been included in the "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies" (1967), so called the Outer Space Treaty that forms the basis of international space law; in the "Declaration on Principles of International Law concerning Friendly Relations and Cooperation among States in accordance with the Charter of the United Nations" (1970) as well as in the "Agreement Governing the Activities of States on the Moon and Other Celestial Bodies" (1979) better known as the Moon Treaty or Moon Agreement.

The Outer Space Treaty of 1967 laid out the main principles regulating space activity, such as freedom of studying and exploring Space, including the Moon and other celestial bodies, no-ownership of celestial bodies, responsibility to prevent potentially hazardous consequences of activity in Space and to protect the environment – specifically Space environment and other planets and celestial bodies. The law also prohibits locating objects carrying nuclear weapons or any other kinds of weapons of mass destruction on Earth orbit, on the Moon, on any other celestial body or station in Space.

This treaty was originally signed by the US, the UK and the USSR. Currently there are 100 countries (States Parties) that signed the treaty since, and another 26 that signed it but have not finished its

ratification.

One of the main principles of the "Agreement Governing the Activities of States on the Moon and Other Celestial Bodies" (1979) provides that the Moon and its natural resources are the common heritage of mankind. States Parties can carry out exploration activities on the Moon and on any part of its surface and subsoils. The Moon is not subject to national appropriation by any claim of sovereignty, by means of use or occupation, or by any other means. Neither the surface nor the sub-surface of the Moon, nor any part thereof or natural resources in place, shall become property of any State, international intergovernmental or non-governmental organisation, national organisation or non-governmental entity or of any natural person.

The placement of personnel, space vehicles, equipment, facilities, stations and installations on or below the surface of the moon, including structures connected with its surface or subsurface, shall not create a right of ownership over the surface or the subsurface of the moon or any areas thereof. (Article 11, p.3). It is also established that in carrying out scientific experiments, the States Parties shall have the right to collect on and remove from the moon samples of its mineral and other substances. Such samples shall remain at the disposal of those States Parties which caused them to be collected and may be used by them for scientific purpose. States Parties may in the course of scientific investigations also use mineral and other substances of the moon in quantities appropriate for the support of their missions. (Article 6).

In addition to that States Parties agreed to establish an international regime, including appropriate procedures, to govern the exploitation of the natural resources of the moon as such exploitation is about to become feasible. States Parties shall inform the Secretary-General of the United Nations as well as the public and the international scientific community, to the greatest extend feasible and practical, of any natural resources they may discover on the Moon (Article 11, p.5).

The main purposes of the international regime to be established shall include: the orderly and safe development of the natural resources of the Moon; the rational management of those resources; the expansion of opportunities in the use of those resources; an equitable

sharing by all State Parties in the benefits derived from those resources, whereby the interests and needs of the developing countries, as well as the efforts of those countries which have contributed either directly or indirectly to the exploration of the moon shall be given special consideration (Article 11, p.7).

None of the Articles of the Moon Treaty directly prohibits exploration of natural resources on the Moon or other celestial bodies. However as national appropriation of the Moon is prohibited by the Moon Treaty and it is acknowledged that the natural resources of the Moon are "the common heritage of mankind", execution of some space missions focused around exploration of natural resources in Space may be limited.

Unlike international space law, this Agreement has not been signed by the leading space nations.

It is worth mentioning that the Moon Treaty classifies only the Moon and its resources under the common heritage of mankind. But before that they did not belong to anybody, and the concept of "the common heritage of mankind" with regards to the Moon and its resources, however, was not defined until the Moon Treaty came into force in 1984.

The Moon Treaty can be compared to the United Nations Convention on the Law of the Sea. This convention declared international area of the seabed and ocean floor as well as subsoils thereof ('seabed' thereafter) the common heritage of mankind and set up legal order of dealing with maritime space and resources.

The most important part of this Convention are the principles which facilitate international communication, promote peaceful uses of the seas and oceans, and establish the most favourable conditions for equitable and efficient utilization of the seabed, conservation of maritime living resources, and study, protection and preservation of the marine environment.

Such activities shall contribute to strengthening of peace, security, cooperation, friendly relations and enhancement of opportunities for all States Parties, irrespective of their social and economic systems or geographical location; shall allow participation in development of the resources of the seabed and shall help prevent monopolization of

seabed use by any State or person.

According to the Convention, the seabed recognised as the common heritage of the mankind cannot be owned in any form and no State shall claim or exercise sovereignty or sovereign rights over any part of the seabed. Natural resources and minerals recovered from the seabed can only be claimed or acquired in accordance with the Convention.

Exploration and exploitation of seabed natural resources shall be carried out under international supervision and shall be controlled by specially established International Seabed Authority in accordance with the Convention and with the polices related to development of seabed resources.

There is no established international Convention that sets out policies for exploration and exploitation of natural resources of the Moon. In order to coordinate exploration and exploitation of natural resources as well as to prevent appropriation of celestial bodies, an international organisation needs to be appointed to control and govern exploration in Space, potentially by giving out international licences in accordance with international laws and procedures.

Nevertheless, the process of "appropriation" of celestial bodies does exist. In 1980 Dennis Hope declared ownership of the whole Solar System and until now has been selling parts of Moon, Mars and Venus land online to anyone willing to buy. Even long before Dennis, in the 18th century Frederick the Great, king of Prussia has given the Moon to the healer Aul Jürgens and his offsprings as a gift for healing Frederick from podagral (uratic arthritis). This fact became known when Jürgens' family threatened Dennis Hope to sue him for selling parts of the Moon.

Hope's claims have been also disputed by a business man Gregory W. Nemitz, who claimed his ownership of Asteroid 433 in 2001, shortly before NASA's spacecraft "NEAR" landed on it [23]. His claims were based on the Constitution of the USA and its provisions that any private person has an integral right to appropriate in private ownership any object that is not owned by anyone without state intervention. Shortly after NEAR's landing on the Asteroid, NASA received a check from Nemitz for parking the spacecraft – $20 per 100 years.

NASA lawyers referred to the "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies" (1967) and declared that such claims have no legal grounds.

Since 2001 a Canadian citizen Sylvio Langevin has filed about 45 claims in total, where he demanded to acknowledge his right to own the Solar System, four satellites of Jupiter and the areas between celestial bodies. According to CJAD radio station, the documents that Sylvio has sent to the court contain his statements that he wants to become the owner of the planets to prevent the Chinese from colonising the space. He is also comparing the right to own celestial bodies with collecting hockey cards. Canadian court recognized Sylvio Langevin as a Vexatious Litigant, and has prohibited him from contacting the court unless he has been given a prior written consent by the judge. Langevin himself accepts that no one on Earth can give him a document, confirming his ownership of the planets, and the only defendant in his lawsuit is God.

In 2002 American specialist in Space law Virgiliu Pop registered online his ownership of the Sun and as a joke threatened to charge Hope, Nemitz and other "owners" of celestial bodies or parts of their surface for using the sunlight owned by him.

In reality however the claims for celestial bodies ownership are not for the full ownership with trinity of powers: power to own (physical possession of an object), power to use (ability to utilize and generate revenues from an object) and power to dispose (ability to make transactions with an object). They can only be seen as claiming the first power to own.

There have been attempts to use the principle of claiming ownership of an object recognised in many countries – namely placing one's property on extra-terrestrial bodies in order to appropriate it. Steve Durst, a writer from Hawaii, USA, has been trying to convince Silicon Valley tycoons to support sending a private spaceship International Lunar Observatory (ILO) to the south pole of the Moon with the objective to get payments for scientific observations and experiments, as well as communication services provided to the other spacecrafts.

Richard Garriott, computer games developer and space tourist,

bought in 1993 Russian moon rover “Lunokhod 2”. He believes that he owns the Moon surface below his rover and potentially “even wider territory”.

The trade of the Moon and Mars territory is wide spread, and even whole asteroids are for sale. Most well-known companies such as “Lunar embassy” and “Lunar registry” sell ownership certificates for certain parts of extra-terrestrial bodies. Specialists of the American Institute for Space Studies have researched the visible part of the Moon’s surface and of the other planets and have divided it into land lots, each of which has its own coordinates and registration number. A standard lot of the Moon land is 1 acre.

Together with the Sale agreement (Certificate) the owner receives a map of the Moon's surface with the land lot bought marked on the map and a Constitution, confirming his rights as a new citizen of Interplanetary Republic. However according to all existing international agreements such certificates are seen as an unconventional souvenir. Despite virtual activities of such companies, Moon certificates are quite popular as a funny present for friends and family.

At the moment there are about 4 mn people from 180 countries who own land on other planets. Amongst them, there are 53 world known politicians – including ex-presidents of the USA Jimmy Carter, Ronald Reagan and George Bush; CEOs of 1753 largest transcontinental corporations, 40 NASA astronauts and 25 European cosmonauts, including the Russian ones; more than 500 world known movie stars, musicians, sportsmen, such as George Lucas, Mick Jagger, Patrick Stewart, John Travolta, Tom Cruise, Nicole Kidman, Clint Eastwood, Arnold Schwarzenegger, Dennis Hopper and many others. There are many Russian well known politicians, businessmen, movie and pop stars as well as athletes who own land on the Moon and on the other planets.

The “Agreement Governing the Activities of States on the Moon and Other Celestial Bodies” (1979) excludes any activities related to such appropriation of extra-terrestrial bodies. However many countries considered this agreement too extreme. It has been ratified by just some of the countries, and there isn't a single space nation among them.

Is there a better solution then spreading the right of ownership to the outer space and extra-terrestrial bodies? Such space resource as geostationary earth orbit (GEO) is already benefiting Earth's economy.

GEO is located along the equator. The satellite on GEO rotates with the same speed as Earth (i.e. always stays at the same point in relation to Earth) hence stationary antennas based on Earth can be constantly connected to the satellite.

The access to such high-demanded area of the Space is regulated by the International Telecommunication Union, ITU. No country owns parts of GEO. They are allocated in "slots" of 0.1 o or about 70km wide. This system has been used for several decades, which clearly demonstrates that it is possible to operate without establishing rules of Space ownership. It is quite possible to use the same system in Space subsoil management: allowing to ustilise other planets without any appropriation of their surface and subsoils into ownership.

There has been a precedent of claiming ownership of GEO though. In December 1976, in Columbian capital Bogotá equatorial states (Columbia, Ecuador, Congo, Indonesia, Kenya and Zaire) signed a declaration about their national sovereignty on GEO asserting their legal claim to control use of Space above their territory. Non-equatorial states have ignored Bogotá Declaration.

Such ethical and legal collisions happen due to the absence of any definition of Space. Where does "Space" start? From which distance do you start applying Space law instead of the aviation low? Air space above continental territory of any state and its territorial waters is under sovereignty of that state, which means national state laws are in force on these territories. Space however is being used for the benefits of the mankind and is regulated by international law.

There are two definitions of where Space begins. Russia is suggesting to use the attitude method: the border between cosmic and air space is at the attitude of space ships' minimal orbit (i.e. about 100-120km above the sea level). The USA is using a functional method: there is no need to define the border between two spaces, it is enough to differentiate between aviation and Space activity which is defined by the type of flying vehicle.

Neither the Outer Space Treaty, nor the Moon Treaty set out the

rules regulating ownership rights to natural resources extracted from subsurface of celestial bodies. According to Article 11 of the Moon Treaty, sub terrestrial resources of the Moon cannot be owned by anyone, at the same time Article 6 states that countries have a right to collect and take from the Moon samples for scientific studies. Natural resources of other planets apart from the Moon are not mentioned in these documents. In reality we can observe how Space materials, such as meteorites, can be owned by anyone after landing on Earth, and they are freely used and traded on the market.

The USA and the USSR in the past have exchanged samples of the Moon surface without any objections from the international community.

On the 18th of November, 2015 the Congress of the USA passed the Spurring Private Aerospace Competitiveness and Entrepreneurship Act of 2015 (SPACE Act of 2015) according to which American private companies are allowed to carry out exploration projects on extra-terrestrial bodies. Soon the document will be signed by Barack Obama, and will gain official status of the law. American senators are convinced that passing this act will boost the US economy and innovation capabilities of American companies, becoming the "highlight" of exploration in Space.

Republican leader in the House of Congress Kevin McCarthy mentioned that this law will provide legal certainty to the Americans who are willing to invest into exploration of natural resources on asteroids. The Chairman of the Committee on Science Lamar S. Smith expressed confidence in the success of private space companies if the bill is passed, although the importance of the law can only be evaluated after several decades.

Passing the low was lobbied by aforementioned American company Planetary Resources. This company's activity is focused on manufacturing and using unmanned space ships for sourcing chemical fuel components, precious metals including gold and platinum, and water. By 2020 Planetary Resources wants to build "fuel storage" in Space.

However non-American specialist in international and Space law regarded the SPACE Act of 2015 as "head-on attack on the main principles of Space law". "The new law is nothing but a classic rendition

of "he who dares wins" philosophy of the Wild West."* Space activity is regulated by the international law and is defined by two principles: the right of States to explore cosmic space and extra-terrestrial bodies and not allowing one-sided and uncontrolled commercial usage of celestial bodies' resources.

Even if a country has not ratified the Outer Space Treat or the Moon Agreement it has to follow the norms set out in these documents when carrying out activities in space.

In the nearest future (provided the execution of the projects to extract natural resources on asteroids is successful, the absence of the legal norms regulating ownership rights to the extracted natural resources - the point when it stops being "the common heritage of the mankind" and becomes someone's possession (potentially bringing huge income) – may become a trigger for international conflicts.

By the way, there is no definition of a "celestial body" or "extra-terrestrial body" in the law. It is common to assume that celestial bodies are objects in Space that can't be moved from their orbits by human force. However if an asteroid can be moved by human force it is no longer (or stops from the moment it has been moved) a celestial body.

Legal consequences of such uncertainties can be quite serious. As our technological capabilities grow, more and larger celestial bodies which are currently considered "the common heritage of the mankind" may be redefined and extracted.

6.3 ECONOMIC PROBLEMS DURING INTEGRATION OF MINERAL RESOURCES OF CELESTIAL BODIES IN ECONOMY OF EARTH

Resources of the Solar system are almost limitless. If theoretical assumptions about rich mineral resources of celestial bodies are confirmed, it will be difficult to integrate them into our economy on Earth. Just one asteroid may contain twice as much platinum as currently produced in the world annually. Experts from Planetary Resources

* Gbenga Oduntan. Who owns space, University of Kent, Kent, UK (The Conversation) Nov 27, 2015. http://www.spacedaily.com/reports/Who_owns_space_US_asteroid_mining_act_is_dangerous_and_potentially_illegal_999.html

estimate the value of mineral resources of each 50-100 meters of an asteroid to be about $40-50bn. They consider Space mining as the first and main step to creating self-sufficient and balanced economy in Space. According to them, extraction of water ice (cracking of which creates components of propellant fuel – hydrogen and oxygen) may create a market worth $1trn*.

There is a good example when economy of a great State collapsed due to excess of gold. Discovery of America and its further occupation in the 15-16th century made Spanish crown the wealthiest State in the world. Rivers of gold and silver were flowing into Spanish Empire ruled by Charles V, Holy Roman Emperor, from the colonies took over by conquistadors. It is estimated that during the 16th century the Spanish have received an equivalent of $1.5trn (measured in 1990 dollars). This period in history is known as Siglo de Oro – Spanish Golden Age, when Miguel de Cervantes, Lope de Vega, and Pedro Calderon de la Barca created their masterpieces.

Because of so much gold in the country it has been decided to charge high taxes. In addition to the usual tithe that each good catholic had to pay, one fifth of all gold mined in the colonies had to be paid into the state treasury.

In addition, there was a special tax on all trading operations – alcabala. The tax was introduced in 1342 by King Alfons X of Castile: originally it was 5 % on any sale made and later on it was increased to 10 %. State budget was spent on maintaining a huge military force and fighting multiple wars around the world by Habsburgs dynasty. Manufacturing was not developing, craftsmen fell into decay because it was cheaper to buy goods abroad. Local producers had to charge more for their goods as the prices in the country went up due to excess of gold. Import was growing and the capital was going out of the country. Foreign goods were being bought not only for Spain itself but also for its colonies. A part of goods went to Seville merchants, who monopolised trade in the New World. The government tried to decrease exports but with no results – contraband traffic was taking the capital out of the country.

* Strauss M. Can Congress Grant Private Companies To Mine Asteroids? http://io9.com/can-congress-grant-private-companies-the-right-to-mine-1621149768?utm_campaign=socialflow_io9_facebook&utm_source=io9_facebook&utm_medium=socialflow

At the end of the 15th century Castile had the most successful sheep breeding in Europe, Andalucia's viticulture and Toledo's gunnery were booming. By the beginning of the 16th century Spanish peasants and craftsmen could no longer sell their products abroad, moreover they could not even compete on local market. By the end of the 16th century bread prices increased fivefold, and general price levels went up more than four times. All economically active population of Spain rushed to colonies for easy money. All Jews and moors were considered "fifth colony" and were expelled from the country in 1492 when Ferdinand and Isabella ruled Spain. Human resources of the country were not great at that time. The state saw the main reason for country's degradation in outflow of capital, gold and silver abroad. Habsburgs tried to prohibit export of gold and silver from Spain, but it only pushed up inflation. By the end of the 17th century there was a saying: "En España todo es caro, excepto la plata" – in Spain everything is expensive except for silver.

It is worth noting that significant increase in prices happened not only in Spain. In Europe prices went up 2.5-4 times on average by the end of the 16th century. Introduction of a new technology – amalgamation allowed cheaper extraction of precious metals from ores with low content of useful components, which contributed to growth in prices. As a result during the period 1460-1530 the volume of silver production increased 5 times in Central Europe.

Slowly manufacturing and agriculture in Spain declined. Most weaving workshops in Toledo closed down, in Granada production of silk stopped, clothing manufacturing in Saragossa and leather production in Andalucía withered away. Spain became indebted and it took about 100 years for its economy to recover.

Supporters of extraction of natural resources on the other planets have been studying the best ways to integrate extra-terrestrial supplies into existing markets. Jeff Greason who works for XCOR, the company engaged in sub-orbital flights, suggests: "You keep you reserves of platinum (or whatever else you have) and release it to the market in small portions during 20 or more years". Platinum group metals are the most promising natural resources expected to be extracted in Space. They are not only a saving instrument, but also production

feedstock. At the moment, explored reserves of platinum on Earth are not enough to convert all cars to hydrogen and equip them with fuel elements. Growth in supply of platinum group metals will create new opportunities for stable development of energy industry. Eric C. Anderson, co-founder and co-chairmen of Planetary Resources stated: "I am often asked whether stock markets are going to be affected by oversupply of precious materials from Space to Earth. I hope that exploration on asteroids will have a big effect. I would like to see the energy price and cost of natural resources decline in the long term. Rare materials are extremely important for such industries as renewable energy, medical equipment and electronics, that's why supply of them to Earth is a viable business. We are not trying to just impact the prices, but we want to use resources of Solar system to create a world of abundance".

6.4 ETHICAL ASPECTS DURING EXPLORATION OF MINERAL RESOURCES ON CELESTIAL BODIES

The most important first step during colonisation of celestial bodies for using their mineral resources will be the choice of a place for future settlement. Remote research of this topic has started already. The caves discovered by NASA's lunar orbiter in the Marius Hills, in the Sea of Dreams and the Sea of Tranquility of the Moon may become good places for Moon stations. These locations are protected from cosmic radiation and daily temperature fluctuations. Lunar crater Piri located by the north pole of the Moon is covered by sun light all the time, which makes it ideal for building a solar station, that will be delivering energy for extraction of ice from the bottom of the crater. On Mars the location which is considered the best for colonisation is Ellada plane, the lowest point on Mars (7 km below the average surface level). The largest glacier is located there and atmospheric pressure is the highest to allow liquid water to flow (it is important for getting drinking water and for splitting the water into rocket fuel components).

Once exploration of celestial bodies begins, there will be locations for Space tourism as well. One of the first places on the list will

most likely be the location where Apollo-11 landed on the Moon (base Tranquillity). In 2010 California nominated this place in addition to other 106 objects into the California Register. The US government is planning to apply to UNESCO to include this area of the Moon into the world heritage list.

Getting close to implementation of potential opportunity to use mineral resources of celestial bodies requires a significant revision of the concept around ownership of these bodies, their natural resources, as well as legal and ethical principles of using them. The way they were laid out in the Space law and the Moon Agreement does not correspond to modern needs and requirements.

The main ethical topic in aforementioned documents is a dilemma about what celestial bodies and their resources are: the common heritage or the province of the mankind – international community decided in favour of the later (the common province of the mankind, open for studying, exploration and use). Objects considered "the common heritage of the mankind" must be preserved in its original form for future generations, unlike the objects that fall into the category "the common province of the mankind": they can be used for the good of all humanity provided there is a special international regulation in place.

If one day the Moon becomes a centre of mining industry, ethical conflicts are very likely to evolve around exploration and mining of natural resources, similar to the ones mined on Earth. Or around the consequences such as general pollution of the atmosphere and subsoils by technogenic waste created by mining industry, or change and even complete destruction of original landscapes and reduction of gas generation.

Astronomic Moon observatories as well as Moon tourists may not be able to enjoy beautiful Moon landscapes and views because of the dust in the air created by mining operations. Settlers and tourists may suffer from acoustic pollution. When on the 20th of November 1969 Apollo-12 crew discharged a lunar module on Moon's surface, it hit the surface and initiated moon quake, with the sounds spread over 40 miles from spaceship's landing location. The consequences were unexpected: as per NASA report, after that "the moon was vibrating

like a toll" for one hour. Apollo-13 crew repeated the discharge of a module on purpose increasing the strength of the impact. The results were just astonishing – seismic devices registered Moon vibration length of 3 hours and 20 minutes and its distribution radius was 40 kilometres.

Without a doubt when exploring celestial bodies one should follow ethical principles developed by geoethics for implementation during studying and using mineral resources of Earth (see chapter 2).

It will be quite challenging to follow p.7 Article 11 of the "Agreement Governing the Activities of States on the Moon…" directly, in particular its part describing fair distribution of goods, created whist using Moon's resources, especially when taking into account interests and needs of developing countries. How can such goods be distributed fairly between the countries that did not take part in exploration projects, but are considered "developing"?

How is it possible to make private companies take into account interests of developing countries when distributing the goods created by exploration of extra-terrestrial resources?

During implementation of mining projects on Earth, ethical tool that is being used is called social responsibility of the business, i.e. responsibility of those, who makes business decisions, for those who are directly or indirectly impacted by these decisions (paying taxes on time and stable salaries at socially acceptable levels, providing safety at work and additional medical and social insurance for employees, developing human resources, etc.).

In some cases it can be voluntarily contributions of mining businesses to help development of society in economical, ecological or social areas, which can be directly or indirectly connected to the main activity of mining business (sponsorship, corporate charities, contributions for environmental protection, readiness to take part in liquidating the consequences of natural disasters, etc.).

If mining business projects are taken outside of Earth surface, degradation threat to natural and geological environment of Earth will be prevented on some of its territories, in particular those of developing countries. In Europe mining activities have already been minimised. Hence implementation of mining projects on celestial bodies

in itself becomes socially significant activity, contributing to saving natural environment on Earth and executing one of the main basic rights of a human – right to a healthy living environment.

Without a doubt future colonisation of extra-terrestrial bodies and usage of their resources will require defining some of Moon objects as the objects of geological heritage – geological elements created during natural geological subsoil evolution of extra-terrestrial body and its surface, and elements that became valuable during its geological evolution or will become valuable in the future. Such objects shall be studied, preserved, used and passed on to the future generations (see chapter 7).

At the moment there are 5 such objects identified by the scientist studying the planets of the Solar system: Chao Meng-fu crater on Mercury, Seven Sisters caves on Mars' volcano Arsia, volcanic lava lake Loki Patera on Jupiter's moon Io, mountain range Toledo on Saturn's moon Iapetus, dwarf planet Haumea in Kuiper belt.

Chao Meng-fu crater is located around the south pole of Mercury and is 167 km in diameter. Despite the fact that the temperature on majority of Mercury's surface can reach 430 °C, the axis of the planet is perpendicular to the orbital plane in circumpolar areas hence the sun always stays close to horizon and there is almost no light, so the temperatures may fall below -180 °C. In such conditions water ice as thick as 2 meters covered with a layer of dust can exist deep at the bottom of craters like Chao Meng-fu, which has been confirmed by the interpretations of radar observations.

Further studies of Chao Meng-fu will help define genesis of the ice, its composition and age. According to one of the hypothesis, the ice may have appeared there about 4.6-3.8 bn years ago as a result of an intense comet bombing. Comet ice was evaporating immediately after landing on the sizzling hot Mercury's surface however at the bottom of dark polar craters moisture could have condensed.

First caves on Mars were discovered in 2007 by Glenn Cushing from Geological Survey of the USA. All together they were named Seven Sisters – separately Abbey, Annie, Dena, Jeanne, Nikki and Wendy. At the moment they can only be seen as rounded holes on the side of Mars' volcano Arsia. The diameter of the biggest cave is about

200 meters. Perhaps they are not deep and may represent partially destroyed lava flows, however they may also be an opening to a larger network of underground caves. In any case, internal area of these caves is covered from severe conditions of Mars and may serve as a haven for extra-terrestrial bacteria and microbes.

Patera Loki is a 250 kilometres wide lava lake, one of the biggest in Solar system. It is located on Io, the innermost among the four biggest moons of Jupiter. Patera is the name for volcanic cones with very gentle slopes, semi-destroyed caldera walls and radial lava flows on the slopes. Most of the time caldera Loki is covered by lava crust. However roughly every 15-18 months frozen lava is bursting with new lava flows as hot as 700 °C. Heat transmitted by Loki can be captured by infrared telescopes located on Earth. Patera Loki is stronger in its volcanic power than volcanoes on Earth all together. This incredible volcanic activity of Io is supported by tidal forces coming from Jupiter. Studying Patera Loki will be helpful in modelling early volcanic activity of Earth, when the flow of geothermal energy was a lot more intense, similar to what can be observed on Io now.

Equatorial ridge Toledo on Saturn's moon Iapetus is higher than the Mount Everest – it is 1300 kilometres long which is about 1/3 of the equator. It is twice as long as Perinea and gives Iapetus a creepy look – the moon looks like a walnut hanging in Space. Some scientists think that the ridge is a tectonic anomaly caused by fast rotation speed of Iapetus in the distant past.

Elongated eccentric dwarf planet Haumea from Kuiper belt, orbiting further than Neptune – is one of the coldest bodies of our Solar system. Its surface temperature is -220 °C and its size is about 1960 kilometres in its major axis, which is comparable with Pluto diameter (2390 kilometres). This planet is considered one of the largest inhabitants on Kuiper belt, which includes many plutoids, consisting mainly of methane, ammonia and water ice. Haumea is different from them as it made of mainly dense rocks covered in thin layer of ice and has on its surface a large area coloured red, potentially rich in mineral formations. Haumea was significantly larger in its distant geological past, however it lost part of its ice blanket as a result of colossal collision at the edge of Solar system. A whole family of bodies was

discovered in Kuiper belt smaller in size and similar to Haumea in its physical and orbital parameters. Potentially they are fragments of the same collision. Two fragments like this are orbiting around Haumea. They are named Hi‘iaka and Namaka and are the moons of the dwarf planet. More detailed research of Haumea may provide new information about the stages of Solar system development.

Conditions on the Moon are completely different from Earth, that’s why in all projects of its future exploration the Moon is seen as colonisation objects, whereas the projects on Mars are not only about colonisation but also about its terra-forming. The main ethical value of Mars is in its potential to become “a reserve Earth” in case of serious global disasters that may make Earth unliveable (collision with cosmic bodies, nuclear, chemical and bacteriological wars, environmental pollution, climate changes, risks resulting from creating artificial intelligence and nano-technologies, etc.).

In case of a global catastrophe on Earth – life will disappear, including intelligent life, potentially the only one in the Universe. A small settlement on Mars may help to preserve a lot: humans, animals, plants, knowledge, records about human race development and evidence of its culture.

Terraforming projects imply creating on Mars the atmosphere with such pressure that allows water to exist in liquid form; increasing temperature to +10 °C - +20 °C in equatorial area of the planet by using greenhouse effect, created by perfluorocarbon compounds; replicating ozone screen of Earth to protect Mars from ultraviolet radiation; and developing biosphere.

In order to implement these plans it is suggested to perform one of the following actions:

- Controlled collapse of a comet or asteroid on Mars from the main belt, for example Cerera, or one of Jupiter’s moons, with the aim to warm up Mars’ atmosphere and to saturate the planet with water and gases;
- Explosion of nuclear bombs on Mars’ polar cups to create water;
- Locating artificial satellites on Mars’ orbit capable of gathering and focusing the sun light on the planet’s surface to warm it up

The aim itself to terraform celestial bodies as well as the methods suggested raise ethical concerns rather than questions about technical viability of such projects. Does Earth civilization have an ethical right to enforce such massive changes (in fact – destruction) to existing celestial bodies at the very initial stage of terraforming, even if there is no life on them in the form our civilization understands it? So far there is no evidence of organic life on Mars. Perhaps it exited there millions of years ago. May be it does even exist there currently in some basic microscopic forms. Should we respect the right of these forms to exist, when on Earth we continuously fighting with microbes and bacteria, and bioethics acknowledge the right to exist and live of higher animals and plants only? How well should we research Mars to find life forms before we can announce this planet ours? Should we leave Mars if we find life there? Do we have the right to pollute it with microbes and bacteria from Earth? Possibly terraforming process will create better conditions for existence and development of hypothetical life on Mars.

In nowadays world, when building ethical relationship between human civilization and nature on Earth, instrumental mind of the mankind ran into its own boundaries. Only by means of strong imagination people can assess the consequences of self-inflicted technogenic actions impacting and changing natural environment of extra-terrestrial objects, as opposed to the consequences of military actions and even nuclear wars, which have been "modelled in nature" by humans.

Provided there is no life forms on celestial bodies, when making decisions about terraforming these objects we should be guided by an appeal of a German philosopher H. Jonas. He has articulated ethical categorical imperative of our age in a formula "Humanity shall live!"

As a result of terraforming Mars our next generations will have quite large suitable for life territory on Mars' surface, potentially with quite significant volumes of mineral resources.

Without a doubt before starting terraforming, objects of geological heritage need to be identified on the surface and in the subsoils of Mars in order to pass them on to future generations.

Analysis of geological and biological evolution of Earth shows that processes, which happened in geological history of our planet (tec-

tonic activity, movement of the continents, formation of mountains, marine transgressions and regressions, change in atmospheric composition, catastrophic exogenic processes, etc) did not stop development and evolution of life. According to modern natural science such exceptional fundamental strength and immunity of life is explained by its most important qualities such as universality, inhomogeneity of development and versatility, which have improved with geological evolution of Earth. Most likely these qualities may be applicableto the whole Universe and moreover to life that has a fundamentally different base (for example, silicon-fluoro-ammonium, hydrocarbon or any other) when compared to biological forms on Earth in its speed of life processes.

If an extra-terrestrial object suggested for terraforming happens to be inhabited, no attempts should be taken to change it. Underlying premises of bioethics and ecological ethics give the rights to exist not only to the highest forms of life, but also to already developed species, communities and ecosystems. However if during terraforming of a celestial body its inhabitant life forms may disappear even if they are the most primitive forms, it may decrease biodiversity of Solar system, especially if such life forms are non-carbon.

Existing Space exploration projects resemble with strategies and tactics of the leading world powers in the 16-19th centuries, when they were colonising overseas territories on earth: new territories, exploration (usage) of all resources for prosperity of mother lands, creating settlements, building strategic objects, military bases, etc. without considering existing landscapes, ecosystems and the need to preserve the environment.

Some major Space powers consider future Moon stations as a launching ground for potential military presence, including building missile stations on the Moon. Despite demilitarisation of Space, it is important to take into consideration the latest trends around possible revisions of the current Space law, similar to how it was done with the US missile defence program. There are even suggestions to create a base which can be converted into a military station in a short time, including locating at that base nuclear missiles that are difficult to reach from Earth. Such discussions and plans may become an additional

deterrent in current geopolitical situation.

Lunar bases may also serve as places for reserve communication and navigation systems' deployment in case orbital satellites stop working for some reason.

It is worth mentioning that unlike terraforming, natural processes of planetary changes (evolution) are inevitable. They are defined by geological processes on the planets of Solar system and in a very remote perspective – evolution of the Sun and the Universe. When questioning how long humanity will exist in evolving Universe we realise that if there are catastrophic changes to the Sun in the distant future, Mars will become the first destination for human migration.

As the Sun burns hydrogen fuel it will become hotter and as a result will be using the remaining hydrogen quicker. As a consequence its emittance will grow by 10 % every 1.1 billion years. One billion years from now due to increased emittance of sunlight circumstellar inhabited area around the Sun will move outside of the current Earth orbit. Earth's surface will heat up so much that liquid water will evaporate and life on Earth will no longer be feasible. However the temperature on Mars' surface will increase by that time, water and carbon dioxide frozen in the subsoils of the planet will be released into the atmosphere, creating greenhouse effect, and increasing the speed of warming up the planet. It is very much possible that Mars' atmosphere will naturally reach the conditions similar to Earth's environment and Mars may well become a potential home for life for another 4 billion years.

Approximately in 5.4 billion years from now the core of the Sun will become so hot, that it will lead to widening of the upper layers of the star and the Sun will transfer into the phase of "red giant" with radius 256 times larger than its current size. Quite possible that during this period the conditions on Saturn's moon Titan or Jupiter's moon Europa, both of which have liquid water under their icy shells, will change and become suitable for maintaining life.

After another 100 million years, when the Sun becomes a "white dwarf", its temperature will fall drastically and humanity will be forced to seek refuge outside of Solar system.

The speed and the scale of terraforming planets are simply not

comparable to their natural evolution cycle. Due to growing population, increasing consumption, and deterioration of environment humanity cannot wait billions of years, when for instance the environment on Mars naturally becomes suitable for life. Additional territories and mineral resources will be needed in the coming centuries. There are no concrete actions taken by humanity to limit population growth or to slow down increasing consumption.

Conclusions: Overall the questions about subsoil use and transformation of extra-terrestrial objects are very specific and cannot always be answered based on our experience on Earth. Considering future possibilities of resource exploration on extra-terrestrial bodies we should take into account strategic importance of such programs for the countries that have technical and technological potential for their implementation. It is necessary to create ethical foundations for further legislation of the following aspects:

- Ability (inability) to acquire ownership rights to celestial bodies, their surface, subsoils and resources contained in them;
- Possibility to conduct studies and research to find the most optimal ways to develop celestial bodies and its subsoils;
- Possibility to mine mineral resources and utilise useful subsoil properties of celestial bodies, and fair distribution of income from subsoil use of Space;
- Ability (inability) to terraform extra-terrestrial bodies on which life forms exist (do not exist), including life forms that have different biochemical base;
- Opportunity to preserve geo- and biodiversity.

CHAPTER 7

JUSTICE IN SUBSURFACE USE

7.1 THE PROBLEM OF JUSTICE IN PAST AND AT PRESENT

The key moral category in the sphere of studying and use of the subsurface and mineral resources and their mineral properties is the category of justice. A measure of justice is, in fact, a common denominator guiding judgments regarding the use of nonrenewable resources, which are limited in distribution, soon exhausted, and belong not only to the living but also to future generations. The idea of justice and injustice is the common denominator of value, which allows making judgments about the justifiability of the nonrenewable resources' use, the basic properties of which include the limited distribution, exhaustion and belonging not only to the living but also to future generations.

In a broad definition, justice can be thought of as the ideal of proper interactions between all members of society. Justice in this sense is indicated by the proportionality of gains and losses, benefits and burdens apportioned between all parties living together. A measure of justice is determined by examing three key elements:

- *Personal rights*: a measure of dignity and respect for each individual,
- *Personal responsibilities*: determining the nature of individuals' participation in social cooperation;
- *Quality of actions committed*: which creates an additional principle of rights and responsibilities differentiation.

All of the existing concepts of justice rely upon commonly shared concepts of ethical behavior and human welfare as colored by regional or national social frameworks, differing world views, and local history. Even Plato and Aristotle considered justice as a social virtue, and the contemporary philosopher John Rawls in his paper "Theory of Justice" refers to justice as the first virtue of social institutions [147]. The existence of justice implies some level of agreement among members

of the community concerning the principles according to which they intend to live. These principles may vary (spontaneously or by decision of the people), but the particular understanding of justice depends on the rules and habits established in the community.

Aristotle's division of justice into the general and private one has traditionally been used in ethics. The general justice covers the questions about the purpose and meaning of the joint, unified, socially ordered existence in society and state. From the perspective of sociological theory of T. Parsons general justice is a social value, which has the orientation function that sets it apart from the specific rules of justice, carrying out the integrative function. The special or private justice is deemed to be the "morally approved adequacy" in the distribution of benefits and harms, and their mutual exchange and recompense for the manifestation of certain properties in the community by its members. From the perspective of T. Parsons' sociology, private justice is a system of specific rules (as opposed to values of general justice).

Traditionally there are three types of private justice distinguished – a distribution (distributional), commutative (exchangeable) and retributive (repaying). This basic division goes back to Aristotle, but in general it remains fundamental to modern ethics as well (Table 10).

Table 10

General classification of private justice

Justice types	Dividing (geometric equality)	Equaling (arithmetic equality)
Distribution (distributional) *J. Rawls*	Distribution of benefits in accordance with the approved criterion (e.g. "To each according to his work")	Equal distribution of benefits
Commutative (exchangeable) *R. Nozick, F. Hayek , D. Gothier*	Unequal proportional exchange	Equal proportional exchange (equivalent commodity exchanges)
Retributive (repaying) *H. Hart, H. L. F. Feinberg*	Unequal proportional reward	Equal reward

The distributive justice in its classic meaning demonstrates itself in all actions, related with the necessity to distribute some benefits among certain groups of people (resources, money, commodities, services, acknowledgement, power, positions, respect, praising, etc.). Such distribution can be performed equally or unequally. In the latter case, a criterion is required for distribution, which can, for instance, be some deserved service or requirement.

The communicative (exchanging) justice is formed on the basis of relation of a commodity (goods, services, respect, mutual acknowledgement, etc.) between social subjects. Such justice can also be discretive and levelling and can be enjoyed both on the basis of equality and proportional inequality. The general moral formulae of communicative justice is the requirement for proportionality and honesty in exchange: fair price, lack of any unfair actions in avoiding any responsibilities taken or requirement for unilateral privileges from the social cooperation that are not related with their contribution into it.

Retributive justice assumes a responsive action related with the reward, which is not associated either to exchange or to distribution, some active action of one subject, who rewards with benefit or evil for some real or imaginative benefit or evil, obtained earlier or assumed to be obtained. Obtaining of such benefit or evil as opposed to exchange is not associated with the presence of a contract or joint activity or mutual limitation. Any type relations are like a two-way traffic road [84]. Examples of retributive justice are gratitude, revenge or punishment.

Aristotle also wrote about the geometrical and arithmetical equality as of types of fair proportionality. Geometric equality implies applying equal criterion to unequal people, resulting in a possible reward of merit, though by unequal measures. Arithmetic equality implies applying equal criterion to people ignoring their real inequality, such as in court. Thus, all three types of justice can be based both on geometrical and arithmetical equality. Distribution for deserved actions – is the same equality, but is geometrical, because people are equal, but not their deservedness.

The levelling justice occurs every time and in all types of relationship of justice (distribution, exchange, reward), if such are constructed on real, simple arithmetic equality: things may be distribut-

ed in equal portions, a fair exchange can be made and rewards can be given at equal measures. The discretive justice occurs every time, when distribution is performed unequally on the basis of some criteria, but still proportionally. The discretive justice exists every time, when such exchange is effected unequally on the basis of a criterion, but still proportionally. The discretive rewarding justice occurs in that case, if reward is not equal to that is being rewarded, takes into account some other circumstances and properties (for instance, the degree of social danger of the wrongdoing.

Despite the obvious significant difference, the types of justice have some internal relation and are parts of the system of justice norms in the wide sense, which was named the 'real justice' by J. Rawls. Any distribution suggests, generally, the exchange, and exchange involves some mutual reward. Allocating the scarce social benefits, such as subsoil for minerals mining, the company builds this allocation on the principles of exchange: ideally the subsoil sites will be allocated to the companies that bring benefits to society – provide economy with the necessary volumes of mineral extraction, that carry out the rational mining, on a timely and full basis pay taxes to the budgets of all the levels, and minimize adverse impacts on the environment and human health, participating in social and economic development of the region, etc. When terminating the mineral mining license, if the company violates or fails to fulfill the conditions of subsoil use (does not perform the extraction, violates the law on mineral resources and environmental protection), the company will not only pay for the evil caused by the offender, but also supports the distribution system, which turns into a kind of exchange between society and the offending company: if it violated provisions of the law or commitments undertaken – it will get punished.

Going up to the level of general justice (valuable ideal) the concept of justice inevitably acquires a conceptual nature, and many of the concepts of justice, like any scientific concepts, acquire their own paradigm. Researchers identify three paradigms of justice, which correspond to the major types of private justice [85].

Retributive paradigm of general justice is most ancient. The original meaning of social justice is a subjective measure of retribu-

tion for good and for evil (Plato's formula “to each his own"). According to this paradigm, justice is not to compare people with each other, but to evaluate each person according to their personal dignity, in accordance with some objective standard. The idea of the revival of the retributive paradigm comes now from such philosophers as N. Fraser and A. Young, and deals with going from fair distribution to fair “recognition", dignified retribution to all members of the society regardless of their contribution and participation in exchanges.

Distributive paradigm of general justice. Perception of distributive justice as a rational and moral basis of social relations formed by T. Hobbes, J. Lock, Kant, I. Bentham. Its conceptual ideas were expressed by D. Hume. He believed that justice is nothing more than a conventional device, necessary to maintain the public order by settling the inevitable conflicts that arise between individuals, who seek to possess the relatively limited resources of the society. It means that justice mainly refers to the distribution of wealth. Consequently, the injustice lies in the fact that a certain individual or a group obtains disproportionately more or less resources than others, and justice turns into a tool for comparing the results of the distribution of desirable and undesirable things and sensations. The concepts of distributive and social justice became synonymous.

The general sense of *exchange paradigm of general justice* is that social justice must be reduced to complex of fair (voluntary and mutually beneficial) exchanges; perfectly fair society is nothing more than the society of fair and mutually beneficial exchanges, and every other justice would not only be useless, but also harmful. However, no impartial rules or government intervention are required; state interference is permissible only for anti-fraud and abuse.

Another important distinction, widely used by modern theories of justice is the distinction between *formal and substantive (substantial) justice*. The substantive justice means the justice of the proclaimed principles, whatever they may be. The substantive justice is the fundamental concept of the organization of numerous institutions. In contrast to the substantive justice the formal justice does not have any statutory preferences; it only requires consistency and constancy when applying any proclaimed rules and in this essence, it contains a

protest against abuse of discretion, which, without doubt, is a variety of injustice [85].

Although the formal side of justice has a variable nature, if we deal with rewarding, distributive or exchange justice, but nevertheless, if one general principle of formal justice states that you should treat any similar things equally and demonstrate consistency. This principle is formal, for it does not clarify what is meant by similar and what "treated similarly" means. For formal justice also occurs in cases, if unjust principles and rules are successively and impartially implemented, however, this would then be a form of occurrence of informal injustice.

Distributive justice has four formal principles of fair distribution: each according to his needs, each according to his dignity, each according to his contribution, and to each equally. Each of these principles may be valid, depending on circumstances. The formalism of retributive justice is expressed in proportional retribution. And the exchange justice is formal in its essence: exchange is fair if it is free and mutually beneficial.

Injustice can result from incorrect and inconsistent application of the most remarkable principles. Corruption and incompetence, bias and non-authoritativeness of those who directly carry out the most equitable principles, their inability and unwillingness to comply with the principles of justice lead to injustice.

It is interesting to pay attention to the judgments of J. Rawls on the issue of what is better - good substantial principles, which are poorly implemented, or bad, but strictly observed principles. Rawls believes that the second principles are better, because it is possible to improve the principles, while in the first case the society deceives itself and the critical point cannot get through this veil of lies [85].

Alongside with informal and formal justice, there is a procedural justice – set of rules that are intended to ensure the justice of the result of this or that action irrespective of all other circumstances. Procedural justice may be:

- pure (mere procedural justice is any auction or tender for obtaining subsoil use rights, if such are performed honestly);
- complete, i.e., that has some criteria, which the procedure is

to be checked against; doing complete procedural justice everywhere, where possible is the ideal of social relations;

- incomplete (state system of licensing of subsoil areas in RF – something like a mechanism of impersonal, but incomplete procedural justice, but which does not guarantee equality of chances and possibilities).

Pure complete procedural justice rarely occurs in the field of subsoil, and in life; in most cases, we deal with some incomplete procedure, which does not guarantee from injustice, which requires from us not only constant care for perfection of procedures (for instance, legislation on subsoil or minerals market), but for external criteria of justice.

On types of concepts of justice that comply with two principally different types of social relations, egalitarian and hierarchic justice types are classified. We should note again that according to Aristotle, justice is always present as equality and inequality: "Justice, as it seems, is equality, as it is, but only not for everybody, but for equal sides; and injustice is also represented as justice as it is in reality, but again, not for everybody, but only for unequal sides". If the egalitarian concepts of justice are important for maintaining initial equality of individuals, hierarchic justice concepts play an opposite role and support initial inequality.

Hierarchic injustice assumes that initial principle is inequality of statuses of individuals and groups, but this inequality is perceived as moral justification (military discipline or military hierarchy are considered to be morally justified) for it expresses the different degree of their perfection, which they demonstrate in serving the highest purposes of this society.

Egalitarian justice is the main valued ideal of western civilisation; it is based on the idea of equality of life chances and possibilities. In an egalitarian society, people are born equal, consider themselves to be such, any occurrence of social inequality is treated in the situation of presumption of innocence and they must prove their right for existence by backing up by the ideal of equality of life chances.

An important characteristic of justice is its in-depth relation with the notion of equality. In the end, this relation is reasoned by the ori-

entation of justice to protect the interests of a specific personality and it is traced at all social-ethical concepts, irrespective of their being egalitarian or non-egalitarian.

Thus, justice is a complex multifaceted category. The actual basis of using the concept of "justice" is presented by D. Hume in his theory of the "Circumstances of justice." The necessity of using this theory is defined by four main conditions:

1. *Moderate shortage of benefits*, if we assume that the state of society is characterized by two extremes - the absolute lack of benefits when their most correct distribution leaves no means for a decent life, and absolute abundance, where any desire can be satisfied without compromising the interests of others.
2. *Limited generosity and benevolence*, since the ability of individuals to sacrifices and cession is limited by the trend of bias treatment to one's own interests and those of the loved ones;
3. *Approximate equality of opportunities and mutual vulnerability*; this is the condition associated with the inability of human communities' members to ensure their own safety, based solely on their own strength;
4. *Mutual dependence*, which is determined by the necessity of presence of other people as participants in the cooperative activity to ensure the material means of life and as partners in interpersonal communication [81].

Any human society requires certain system of fair rules being in force in a particular area within the territorial boundaries of the society in various fields. In this study, we examine justice in the sphere of mineral resources.

The projection of justice ideas onto this area, primarily involves the spread of ethical principles of justice onto the relationships between man and abiotic nature, and the elucidation of the status of benefits arising from inanimate nature. As the relations of distribution, exchange, retribution and justice are present at all the levels of public life, whether the relationship between two people, social groups, collectives, population of a certain country, or humanity as a whole, and the mineral resources are characterized as being limited, exhaustible, non-renewable, belonging not only to present, but also to future gen-

erations, the justice in the sphere of mineral resources can be viewed at least at three levels: between members of the society in a separate national state, between states (international justice) and between the generations.

7.2 JUSTICE IN THE SYSTEM OF "HUMAN BEING – ABIOTIC NATURE"

The existence of modern humanity is inconceivable without the use of mineral resources and mineral properties of the subsurface. In the application of ethical principles of justice in relations between humans and inanimate nature (the natural world), we have to note the original anthropocentricity of this idea, because it is a direct attempt to resolve the conflict between the value of the benefits humans receive and the simultaneous destruction of the natural world, the destruction of geological sites, structures and systems, and an inevitable decline in geological diversity. Moreover, the pressure on non-living nature by the fair (or the one trying to be) society with a high degree of probability may be much more significant than the pressure of radical injustice.

The conflict can be resolved only if the inanimate objects are considered to be parties in this relationship, with losses to both nature and humans evaluated as to their justification. Such integration should be based on a geoethical imperative [119], where the interests of nature are defended by individuals and community organizations who are working on their behalf.

7.3 JUSTICE IN THE SYSTEM OF "INDIVIDUAL - STATE"

Every country with reserves of mineral resources has special opportunities to benefit from those resources, but each country also faces special challenges that are attached to those resources. The countries with economies based primarily on mining and mineral production face the problem of "social availability of mineral resources." The concept of "social availability of mineral resources" was first introduced by G. Gold [56], who described a primary conflict that can accom-

pany mineral production. Mineral resources present real opportunities for the growth of extraction-related and manufacturing industries, but conflict can occur when the benefits of resource extraction are not shared with the residents. The residents may shoulder the bulk of the social and environmental costs in perpetuity without receiving a correlative share of the benefits.

Residents may also suffer when mineral production is accompanied by the diversion of limited resources away from other industrial or agricultural production, or increased costs of transportation or materials because of competition from the mineral sector. Existing local industries relying on these same mineral resources may also suffer if the minerals produced are taken outside the country to benefit non-resident markets. The social availability of resources can be dramatically decreased if control passes to multinational corporations or investors whose interests do not coincide with the interests of the host country and its people [56, 57].

In general, social availability of mineral resources is dependent upon the form of state ownership of mineral resources and extracted minerals. Today in most countries, state ownership of mineral resources dominates, which in most developed countries equates to public ownership, including the category of the national heritage. Experts in the field of natural-resource law, analyzing the legal status of natural objects, suggest that for moral reasons the surface and the subsurface should be considered a national resource, the exploitation of which should benefit the population as a whole. Thus, the nation's resources in total can be considered a non-renewable natural object, where rights to exploit can be awarded upon application given appropriate and adequate payments in the form of license fees or other remittances. The obligations of permit holders include the requirement to comply with the contractual conditions of subsoil use, as well as the requirement to insure that their use benefits the public interest and residents of the country.

Consequently, the state as the holder of the mineral resources is obliged to act in the public's interest and insure (through the application of appropriate strategies and economic mechanisms) that maximum benefit is provided to the public. The state must balance

cost-effective solutions for geological study and licensing agreements, mineral production, and control over subsurface use in such a way as to guarantee the greatest social and economic benefits for its people. This can be a challenge because empirical studies have shown convincingly that an improvement in economic growth does not always result in an equitable distribution of wealth within the population.

According to M. Nussbaum [128], key to assessing the basic level of justice of any society is the simple question of "what in this society can be done by a particular person and how free are they to act to improve their standing?" This is not an issue of overall happiness or well-being, but rather a measure of the opportunities available to each individual. By its nature, society can offer opportunities and freedoms that people may choose to use or ignore, but that can affect them by addressing:

1. Life,
2. Physical health,
3. Physical integrity,
4. Senses, imagination and thoughts,
5. Emotions,
6. Practical reason,
7. Membership,
8. Other kinds of living creatures,
9. Game (have an opportunity to play, laugh, enjoy your vacation and entertainment),
10. Control over the environment.

This model demands that countries with mineral-based economies must fairly distribute the benefits of that mineral wealth and provide a better quality of life for the people as well as enhanced opportunities for their future. Justice in the use of mineral resources in the system "Individual- State can thus be achieved by following these principles:

A) Mineral resources must be considered a public (national) heritage; decisions regarding their use should be transparent and subject to public control;

B) Gains won from mineral extraction and use of the subsoil should contribute to sustainable economic development of the

host country;

C) The study, exploration and utilization of mineral resources should be carried out in such a way as to ensure maximum benefit for the citizens of the country, in the territory of which the subsoil resources are located;

D) The economic and financial policies, licenses for access to mineral resources, signed agreements and contracts in the sphere of mineral resources must maximize revenue to the state and yet provide incentives to maintain high levels of investments;

E) As projects for the extraction and use of mineral resources can have either a positive or negative impact on the economy, environment and human health, the decision on their implementation must be carefully weighed in the pre-project stage, with potential impacts identified, researched, designed, and negative consequences either minimized or compensated;

F) Effective management of mineral resources and ensuring of social availability of mineral resources requires submission by the government to regular reporting on the status of mineral resources of the country, with full transparency regarding revenues received and accompanying expenditures; such reporting is required to inform the public.

7.4 JUSTICE IN THE INTERNATIONAL REALM

The issue of justice has obtained new vitality in globalisation era, in the epoch of fast intensification of integrative processes, with initiation of formation of world civilisation. Today, globalisation is far outside internationalisation that started in 1970-80's due to actions of transnational corporations. As an objective historic process, globalisation brought both positive and negative results. Positive trends are associated with expansion of interaction between different societies, economies, cultures, while negative changes are related with the growth of social inequality. And the main consequence here is the loss locality aspect of societies. According to definition of K.-O. Apel, "local perspectives, where particular life measures usually existed, are included in a single perspective of globalising existential world. Local

fragmentary social systems are transformed into a more common and integrated global social system. In reality, locality and particularity come to a conflict with growing globality and universality".

With globalization and advances in technology, nations around the world are beginning to exist and compete on a more equal basis. The division of the nations into first, second, and third world classes increasingly loses its moral legitimacy as time passes, the world becomes more united, and the boundaries between these segments are perceived as an internal paradox and source of conflict. The separation of industrialized nations from the sources of their mineral resources (third world countries rich in mineral wealth) is problematic if the benefits of those resources are transferred to the industrialized nation with little available to the source country. What was once perceived as normal (the exploitation of undeveloped nations by developed ones) now loses its legitimacy: the welfare of rich nations is negatively perceived against a backdrop of other countries' poverty. As a consequence, the global community now expects equal and fair consideration of the interests of all its members. *An ethical imperative of new economic order formed in the process of globalization is stated as the requirement of international justice.*

In the sphere of subsoil use the issue of international justice is expressed as the problem of equality of income distribution from the extraction of mineral resources and participation in mining and use of the subsoil useful properties.

In subsoil field, the problem of international justice is expressed as a problem of equality of distribution of incomes from mining of mineral resources and participation in mining of minerals and use of useful properties of subsoil.

Mineral resources are distributed unevenly in the Earth's crust, which has led to inequality in mining opportunities, income distribution, and industrialization potential. Because of their mineral resources, some countries including Kuwait, United Arab Emirates, Norway, and Australia, came to be leaders in per capita income. For others, such as South Africa, Canada, and Russia, mineral wealth provides welcome revenue. For some countries (for example Azerbaijan, Mexico, and Venezuela), mineral revenue is necessary to power their econ-

omy and stay "afloat." Developing countries that are resource-poor suffer from widespread poverty, poor education, and lack of the kind of medical care available in richer nations.

Humanity has a moral obligation to address the suffering of the poor, this moral obligation does not imply legal obligations. The very existence of rich and poor countries is no legal argument in favor of redistribution, despite the fact that "the dogma of international justice" considers the just distribution resources and opportunity to be at the core of social justice.

According to O. Höffe, what is decisive is not so much just the uneven distribution of mineral resources on the planet, but rather the combination of uneven distribution with each society's own industriousness and subsequent corrections to the initial injustice [76]. In fact, there are many other causes of low living standards and societal distress in addition to the uneven distribution of mineral resources on the planet, including uncontrolled population growth, unwise expenditure of public resources, imperfect tax systems, corruption, etc.

Mineral resources are generally thought of as being beneficial, but too frequently developing countries demonstrate an inability (or unwillingness) to utilize the minerals available in their subsurface to both their short-term and long-term benefit. Inordinate reliance on mineral resources, for example, can lead to a nation having "Dutch disease", where investments flowing into mineral development hijack capital that otherwise would have been available to manufacturing and other sectors, resulting in a decline of other markets and an increase in the cost of living and pressures on the population.

The fault for many of these problems lies not with the population in general as much as it does with the power elite. It is the responsibility of the state (or those in charge) to guide the use of the nation's resources in such a way as to benefit the population, not just selected groups such as foreign investors. Therefore, the implementation of the moral commandment "to help to the afflicted" from the justice perspective is directed not just to those to whom life is bad everywhere, but also to those where poverty was partially introduced from outside through the faults of their ruling elites. This is especially true when underdevelopment has resulted from gross injustice imposed from

outside (colonialism, slavery, forced migration, etc.), and in those cases justice demands compensation from those who committed such injustices.

Benefits gained from mining and mineral production are not always equitably distributed between the people involved in production. It can be argued that those people who bear greater risks or impacts (either temporarily or for the long term) should benefit in proportion to the costs they bear. But relationships and equitable distribution and participation are only valid if all parties are involved in the dialogue. Unilateral decisions by any party are morally irrelevant [112].

Contemporary society's dependence on mineral resources and the uneven geographical location of mineral deposits and their processing facilities, exhaustibility, non-regenerability, scarcity of mineral resources have led to the idea of internationalization of resources with the growth of globalization. According to precise expression of Bertrand Russell "arguments, used by the specialists in favour of nationalisation of natural resources, has now turned into arguments in support of internationalisation of natural resources. Most obvious example of this is oil. It's a little absurd that those very little territories, which appeared to host large resources of oil, should be the only owners of this oil" (Interview, 1959).

But the theory that resources should be distributed as evenly as possible among all states, because they come from nature or God and we all share in that inheritance, does not take into account that the benefits of mineral resources are gained through work. In-place mineral resources are not as tangible, for instance, as such natural resources as forest products, because the end products (raw metals, for example) require a great deal of investment and work to discover, delineate, mine, beneficiate, and smelt the ore in order to produce the end product. This requires a large investment of intellectual, physical and financial resources, and it means that the in-ground resource has very little value compared to the value of the resources that must be invested in order to bring a product to market. Given that the great majority of capital invested in prospecting and exploration is expended on prospects that never become mines, this means that the deposit is as much a labor product as any other produced in other industries.

From legal point of view, the process of internationalisation of world resources that is ignored, contradicts the established international legal norms. For instance, the Charter of economic rights and responsibilities of state, adopted by UNO in 1974, regulates constant sovereign right of states and nations for owning, use and disposal of natural resources in their territories, partly subsoil and their resources.

Of course, we are yet talking about open territorial coverage of mineral resources. In the example of Russian-European cooperation, we can see that the natural task of our European partners is that energy resources of Russia that are vitally important for Europe would not get capitalised by Russia as political resources and could not serve as a key factor for independent geostrategy. The project of energy-political de-sovereignization, which is the basic issue for EU in the "energy dialogue" with Russia contains the following requirements:

1. Requirements of "greater/wider access" to mining of Russian energy sources, requirements in various forms of direct or international control over national deposits;
2. Requirement for levelling of internal Russian prices for gas and other energy sources with the level of general European market;
3. Fight development of Russian energy supplies to Asian-Pacific region;
4. "Rotation team method" (one month in - one month out) of work at energy aource mining regions of Russia;
5. "Readdress the right of nations for national self-determination" for dilution of state sovereignty on subsoil;
6. Establishment of new "non-Russian" energy supplies infrastructure in post-soviet countries.

Should Russia fulfil these requirements that openly illustrate an attempt for internationalisation of mineral resources, it will lead to loss of energy-political sovereignty, to conservation of raw-material model of development and, possibly, to fragmentation of the country.

In future, as the globalisation develops, at the final stage of formation of a single world political-economic, financial-information space and an open society, internationalisation of natural, including mineral, resources, will be inevitable. It will be impossible to stop it

administratively. Therefore, one of the main tasks of geoethics at the modern stage is preventive development and formation of "Ethical fundamentals of internationalisation of natural (mineral) resources". The world community has in its history an experience of developing similar legal documents (Agreement on the Antarctic, 1959, and a number of international-legal acts that form the System of Agreements on the Antarctic (SAA), "Agreement on principles of activities of states to study and use of cosmic space, including the Moon and other celestial bodies" (1967), "Declaration on principles of international law related to friendly approach and cooperation between states in accordance with the UNO Charter" (1970), "Agreement on activity of states on the Moon and other celestial bodies" (1979). But significant difference of these documents from "Ethical fundamentals of internationalisation of mineral resources" is that development of mineral resources at the Antarctic or use of resources of celestial bodies are less economically likely at the moment, and therefore, the factor of getting profit from exploitation is not dawning on human brains. In addition, in the current situation we are to take into account not only the uneven distribution of mineral deposits on our planet, but also the different degree of development of mineral resources in different regions. For instance, in old mining regions, where minerals had been mined in XIX-XX centuries, many deposits have already been exhausted, many have been closed down due to environmental or other problems (for instance, for formation of state reserves fund of mineral deposits).

One might argue that the broad ideal of "internationalization of mineral resources" is modeled in miniature within nations that have a history of mining as well as federal and local legal structures that govern ownership and exploitation of mineral resources, such as within the United States, Russia, Australia, and other countries. Issues of ownership, use and disposal of mineral resources in these countries are settled following the laws adopted in those countries, and on the basis of the relationships between the federal government of such a country and its regions (constituent territories)*. These may include the following models:

* This is not true, however, in much of the undeveloped world where ownership is contested or not established and where the rule of law is not honored.

1. Federal ownership on subsoil (the federal centre only has the right of ownership, use and disposal);
2. Right of federation subjects for ownership (independent (independent from federal centre) (use and disposal of subsoil reserves), specific to confederative states;
3. Joint ownership, use and disposal of subsoil reserves.

Thus, if we look at internationalization of mineral resources as an inevitable process within globalization, that facilitates union of different states and nations into one general humanity civilisation, then this way is assumed to be movement from the aforesaid model No 2 to Model No 1 via Model No 3.

Here, ethical principles of internationalisation of mineral resources could be based on the following provisions:

1. Mineral resources are the property of the entire humanity and open for studies by all states, without any discrimination on the basis of equality and in accordance with international law;
2. Mineral resources are the property of not only currently living but also of future generations;
3. Rational use of these resources;
4. Joint expansion of possibilities in use of these resources;
5. Fair distribution between all member-states of the benefits obtained from these resources, by taking special account the interests and needs of developing countries, and efforts of those countries, who directly or indirectly contributed in development of these mineral resources.

I would also like to mention the liberal interpretation of international justice, assuming the responsibility of the most economically developed countries over the fate of the poor. In works of J. Miller, T. Pogge, in the later studies of J. Rawls the concepts of moral obligation of help, the principles of collective responsibility, as well as the cosmopolitan universalism are justified. The peculiarity of these concepts is that while distinguishing the perception of justice within the national society and justice in the sphere of international relations, they underline that the principles of distribution in a global scale are not applicable. In fact, the moral basis of global relations is presented as a set of charitable measures of support to backward communities.

The idea of help responsibility is not intended to change the existing international legal and economic forms of dependence, and does not solve the problem of justice in the context of globalization.

In the international sphere, one of the principal unsolvable problems is that the disparity between developed and undeveloped nations may never be eliminated. Given the finite resources available to all of us, it is becoming clear that more and more people in the third world will not achieve the current standard of living enjoyed in the first world; the achievement of such equality would require the resources of nine to ten planets such as ours [112]. This situation might change if mankind could develop the technology to extract mineral resources economically on other planets, but this is still a long way in the future.

7.5 INTERGENERATIONAL JUSTICE

The ethical foundation of intergenerational justice is based on the concept that the interests of people in the future (our descendants) must be honored by people living in the present; it is present-day humanity's moral obligation to protect the interests of those in the future. This concept is based on the thesis of G. Jonas (needs reference here) that the possession of power that may threaten someone else's livelihood comes with the responsibility for protecting that other livelihood. The notion that we do not owe anything to future generations contradicts this moral imperative.

Following on this moral imperative, it stands to reason that those currently alive cannot adversely affect natural resources that will be needed by future generations. This concept is not widely understood or appreciated, and it is apparent that the present generation is badly in need of clear and transparent rules governing the relationship between their interests and those of future generations.

A common approach in studying and specification of the debt owed to future generations is utilitarianism [157]. For proponents of this approach, the issue of whether we have any obligations to our successors is already settled because the relative usefulness of a resource does not depend on the time when people are using it. If a resource is useful today, to fail to make use of it would be a mistake if it was

certain that the resource would never be used in the future. If we believe that the resource will have some utility in the future, then present use is problematic because the average utility of a mineral resource should be neutral with respect to time. Early generations would have to sacrifice disproportionately in order to preserve resources for future ones. Taking into account the unlimited number of people belonging to future generations, the welfare of the present is too easily sacrificed for the sake of future welfares.

Following Koopmans' model [10], suggesting that only one of the successive generations can make investments that increase the welfare of their descendants, the optimal savings rate comes close to 100 % of national income. Even so, in the more realistic model of Arrow [10], where investments in any generation are designed to improve the situation for future generations, the suggested level of savings is still unacceptable, at two-thirds or more of the national income. The prospect of boundless numbers of future generations makes it necessary for each generation to maintain this unacceptable level of savings. This means that consumption by any generation in excess of the minimum necessary to maintain existence becomes morally prohibited.

This problem is partially resolved by way of introducing discounting moral importance of future events. It is possible to avoid excessive self-sacrifice only if the loss of the living and the loss of future generations will not have equal weight when making today's decision. For example, if today's economic losses due to preservation of proven mineral deposits with the purpose of preservation of certain sources of mineral raw materials for future generations, will be evaluated as more significant than similar future losses, which may arise due to the depletion of these resources. In this case, if we can morally justify this approach, the methodology applied for calculation of benefits and costs will retain its justification for making those decisions, the consequences of which will be felt in a long historical perspective.

Conservation for future generations of any discovered and explored deposits is not effective, not only from the economic perspective but also because it is difficult to predict which types of deposits will be of utility in the future. For clarity, imagine a simple, though quite exaggerated, example. What if our ancestors 10,000 years ago

left untouched several large reserves of flint suitable for the manufacture of arrowheads so that we would benefit today? It would have been a noble effort and a pointless sacrifice.

The complexity and unreliability of various schemes of discounting of future would lead to readdressing of the very fundamentals of decision making that is related with interests of future generations. We limit our sacrifices for the sake of future not because "the importance of future benefits drops", but because "no generation may be required to make such sacrifices on the basis of morals of the sake of future generations, who would exceed a certain level" [38]. And the methodological tool of the utilitarian system is unlikely suitable for determination of such level. The contract theory of justice is used for this purpose.

The key feature of relations between existing and future generations is their dual asymmetry – difference of interests of generation and their capability to influence each other. On one hand, if current generation is capable of damaging or benefiting future, then it does not work from the other side. On the other hand, future generations are interested in reasonable actions from previous generations, while the previous generations are indifferent to actions of future generations. In such circumstances, no true mutuality is possible, partly, it is considered in contract theories as basis for fair relationships. Here we lack two of the four circumstances of justice of D. Hume – mutual dependence and approximate equality of means of influence of people to each other [141].

Although it is difficult to imagine a hypothetic contract between generations on fair use of non-renewable resources (actually a contract of unlimited number of people, separated by significant time intervals), nevertheless, assuming that representatives of different generations not only replace each other, but also simultaneously exist within one society and without doubt need each other, they only don't know their position in the succession of generations, then we can conclude that reckless, irrational, inefficient use of mineral resources and useful properties of subsoil deprives not only those, who are not born yet, but also those who are now infants, and consequently, in some time, will ensure welfare of adults who are currently getting old.

And in the situation of reckless use of non-renewable resources these yet infants, having grown up, will have full moral rights to refuse to cooperate with the old people in response to the lack of care of their interests. In turn, current children find themselves tied up with a bilateral cooperative scheme with their successors, etc. This circumstance creates a chain of mutual dependence in time and serves as a motivating ground for the contract between generations [143].

Since the end of XX century in the countries, whose economy is based on mining of minerals (Venezuela, Kuwait, Oman, Norway, Russia, Chilie, etc.) started forming sovereign accumulation funds. Despite the fact that the countries gave the funds different names, in their essence they can be classified as funds of stabilisation type and funds of future generations. The purpose of creation of such funds for future generations is ensuring cash flows in future after exhaustion of reserves of minerals or growth of budget expenditure (for instance, as a result of ageing of population). The idea of establishment of future generations funds is sufficiently simple: when the country is receiving income from exploitation of mineral resources, which should get exhausted in a time interval, then it is expedient to save part of these profits today. At exhaustion of mineral resources, the state will be able to finance the increased budgetary expenditure owing to the funds, accumulated in the specially established fund.

In creation of future generations funds, the state can simultaneously foresee two aims: long term inter-generation levelling of incomes and levelling of incomes and expenses of state budget in mid-term perspective (these purposes are compliant to each other). The duality of the purpose is justified by the fact that the minerals-dependent economies face two problems: exhaustion of resources (in long-term perspective) and variation of prices for minerals (in mid- and long-term perspective). How expedient is such transfer of consumption from present to future?

From the position of the theory of utility, a certain set of benefits in a rich society have less usefulness than the same set of benefits in a poor society, which is explained by action of the law on decreasing the utility limit. Therefore, transfer of use of benefits from present to future may change the assessment of utility (usefulness) of these ben-

efits. All will depend on the fact that future society (when the transferred benefits will be consumed) will be more or less rich than the currently living society, and how significant the difference will be. Accepting the assumption on economic progress, the future society should be richer. Consequently, the utility of transferred benefits for consumption in future will be less [167].

A future generations fund may be formed from internal incomes of national economy and from external sources – momentary incomes of budgetary system, obtained owing to favourable foreign economic market conditions. In practice, such funds are established mainly from outside incomes, which allow stabilising national economy due to changing foreign economic market conditions. A.N. Sukharev formulated the main rule of placing the money from the fund: if the funds are established from internal incomes, then they must be placed within the national economy, while funds are established from foreign incomes, then money can be placed outside the country. In other words, establishment of the fund should not damage the external balance of the country; on the contrary, it should help achieving such balance.

An example of establishing a fund owing internal taxes can be deduction of part of tax incomes for funding pensions in future – establishment of pension accumulations. Pension accumulation represent savings of the state for ensuring payment of pensions in future and in its essence, are similar to the mechanism of future generations funds. On the contrary, the future generations fund can take functions on financial source of payment of pension in future.

Establishment of the fund from foreign incomes is caused by changing foreign economic market conditions that lead to abrupt variations of export incomes of the country and incomes of the budget system, mainly of federal (central) budget. And the necessity in creation of the fund is explained not by resolving the problems of financial provisions of any expenditures in future, but resolving the problem of balanced state of national economy currently. The process of establishing the fund from foreign incomes is not even, funds are injected in years of favourable foreign economic market conditions (the better the market conditions are the more funds are received to the fund).

In formation of the fund from internal sources, the cash flow into

it is smoothed and not so volatile. We already mentioned the inexpediency of creation of a reserve fund for future generations by way of conservation of explored mineral deposits due to uncertainty of future and existence of high probability of lack of the necessity in preservation of certain types of mineral resources as a result of change of techniques, invention of alternative replacements or secondary processing.

Therefore, when striving for the fair distribution of mineral resources between the generations it is necessary to take into consideration the following factors:

1. Mineral resources still in-place have not been yet fully delineated, mined, processed, and have provided no marketable products that are available to the community; their production requires much labor and financial investments;
2. The possible waiver of any extraction of mineral resources, such as hydrocarbons, at present for export sale in the territory of the countries with economies in mineral resources-based economy means the waiver of the country from national economic development, as it leads to a decrease in economic and investment activity;
3. Conservation of proven mineral reserves results in a loss of income investment and financial benefits that could be available to both the present generation (in the form of income); with respect to living standards, it is not the preservation of minerals for the purpose of their future mining that may be appropriate, but mining of the minerals today and capitalization of income received therefrom. Income in the present is more valuable than an equivalent income in the future.
4. Following an optimistic scenario of the development of society, we should be richer in the future than at present. Today, mining may provide a higher share of society's income, and in future probably less. Therefore the usefulness of extracted minerals is highest today.

Therefore, when striving for the fair distribution of mineral resources between the generations it is necessary to take into consideration the following circumstances:

1. Mineral resources in the interior of the subsurface have not

been yet proven, mined and are not in the immediate disposal of the community; their production requires labor and financial investments;

2. The possible waiver of any extraction of mineral resources, such as hydrocarbons, at present for export sale in the territory of the countries with economies in mineral resources-based economy means the waiver of the country from national economic development, as it leads to a decrease in economic and investment activity;

3. Preservation of the proven mineral reserves leads to the denial from receipt of the investment income from the capitalization funds from the state, accrued in the funds for future generations; from the living standards' perspective, for the countries with mineral resources-based economy it is not the preservation of minerals for the purpose of their future mining and sale at higher prices that may be appropriate, but mining of the minerals in present and capitalization of income received therefrom;

4. According to the optimistic scenario of the society development, future should be richer than present. There is no need to resort to excessive savings of minerals in the subsurface at present, as nowadays mining provides a higher share in the society's income, and in future it will not be as significant, and therefore, at present the usefulness of the extracted minerals will be higher than their usefulness in future economically developed society.

Following the reasoning above, the extraction of mineral wealth today will be best for future generations if production is expanded today provided that the rate of extraction does not exceed the rate of discovery of new reserves. If the two are balanced, it will allow society to take into account the changing needs of various types of useful minerals without burdening the future with resource shortages.

A key feature of the relationship between current and future generations is a double asymmetry - a difference of generations' interests and their ability to influence each other. On the one hand, if the current generation can harm or benefit the future one, then this process does not work in the opposite direction. On the other hand, future generations are interested in the reasonable actions of the previous genera-

tion, while the previous generations are indifferent to the actions of future ones. It seems that in these circumstances, genuine reciprocity is impossible.

It is difficult to imagine a hypothetical agreement between generations about their fair use of non-renewable resources, but it is true that the mindless and inefficient use of mineral resources will deprive not only those who are not born, but also those who are now in their infancy. It may be that only those who are currently aging adults benefit from current mineral production. In the case of the reckless use of non-renewable resources, a case can be made that the children of today and the future have the moral right to refuse support in the future to those who pillaged resources held by the community. In their turn, today's children become bound by the same responsibility as their fathers, which serves as a motivating reason for agreements between generations.

Recently, countries that rely on income from extractive industries (Venezuela, Kuwait, Oman, Norway, Russia, Chile, etc.) have expanded their investments to sovereign savings' funds, referred to here as "future generations' funds." Such funds are created by saving a percentage of the income received from mineral resources prior to their depletion, often through taxation of the gross proceeds. Upon exhaustion of the mineral resources, these funds can be used to support programs benefiting those affected by the closing of mineral production. Two goals can be pursued: long-term inter-generational income leveling, and leveling of income and expenditures of the state's budget in the medium term. The duality of purpose is determined by the fact that countries with mineral resources-based economies face two problems: the exhaustion of resources in the long run, and fluctuations in their prices.

Future generations' funds can be generated from internal taxes applied to elements of the national economy that are related to mineral production, or from taxation (in various forms) of foreign investments or external revenues. In practice, such funds are formed largely from foreign income or investment that helps to stabilize the national economy. Future generations' funds should be used only for financing of future costs of state and society.

Many researchers believe that a hypothetical agreement that insures fairness between generations greatly complicates responsibilities to future generations. In this regard, the followers of the intuitionistic theory of justice [19, 25] contend that mutual benefit is a secondary principle of justice, and the lack of opportunities for mutual exchange of benefits alters the nature of responsibilities. Their main thesis is that for the generations of today, it should be necessary and sufficient to live and develop sustainably. By living sustainably, all obligations to future generations are met as long as the present generation does not act so that their heirs inherit a smaller amount of potential benefits than they themselves enjoy.

Partnerships between generations are not necessary so long as each generation understands and acts upon the responsibilities inherent in having a common heritage. Each generation is both a user of the Earth as well as an administrator, which forces each generation to live and develop the resources sustainably. Each generation must leave the planet in no worse condition that it was received.

Conclusions:

In today's world, the competing interests of groups and individuals with respect to their use of natural resources have reached a high level. At such times, the concept of justice in the use of resources becomes key, and requires us to consider the morality and ethical status of our behavior.

The classic conceptions of justice have been described through history by Aristotle, Hobbes, Rousseau, Kant, Rawls, Nussbaum, and others, but when it comes to the use of subsurface resources and the long-term effects of mineral production, these approaches prove insufficient. For mineral resources that are limited in both geographic distribution and quantity, we have to consider justice between individuals and the state, between states, and between successive generations of users.

Justice in the use of mineral resources in the system "individual - state" can be achieved if subsoil and mineral resources are held in the public's (national) interest, with all decisions made on their use transparent and all gains contributing to the sustainable economic development of the public as a whole. The existence of sustainable de-

velopment should in itself provide sufficient justification for insuring justice between generations. Justice between nations is another matter that is often burdened with unresolvable problems.

CHAPTER 8

RESPONSIBILITY IN SUBSURFACE USE

8.1 RESPONSIBILITY – KEY CATEGORY OF GEOETHICS

As a social-philosophic category the notion of responsibility has been determined relatively recently. H. Jonas explains this by the fact that the level of responsibility is related with the measure of power and knowledge and they have been limited during the pre-industrial era, and therefore the issue of consequences of actions had to be addressed "naturally", i.e., as such consequences occurred [82]. From the classical philosophical standpoint, responsibility was mainly studied indirectly – via such ethical categories like morals (morality), duty, good and evil, freedom and necessity. E. Kant, was the first to use the categories of "responsible" and "responsibility" already in XVIII century; he determined them as adherence to categorical imperative and absolute moral law. I. Bentham and J.S. Mille, brightest representatives of utilitarianism assumed that "benefit" for the object of responsibility serves the criterion of rationality. In 1960-70's, ethics of responsibility was developed as an independent part of ethics owing to H. Lenks's works who determined responsibility as a notion, which is reflected in relational application of the norm with the help of assessing controllable expected actions. Y. Habermas and K.O. Apel further developed the concept of responsibility as a consensus. They applied an inter-subjective feature to ethics of responsibility. Due to constantly growing technical power of civilisation and together with it – the danger of large-scale man-caused catastrophes that threaten existence

of humanity and nature, in 1980's H. Jonas declared that traditional ethics had exhausted itself and a new ethics concept was required to be a base for principles of responsibility. Ethics of responsibility has to step in to replace all ethical concepts [82]. For the planet Earth is an absolute value of life and mineral resources of this planet – basis for its existence, then responsibility is the central notion of geoethics.

Responsibility is a notion that means the necessity of a person to justify his objectives, actions, consequences, situations to an addressee or subject, in relation to which such person has obligations or duty to submit justifications of his actions in accordance with standards, criteria and norms. The notion of responsibility gives a structure of norms and actions to the social reality and social relations [50].

The objects of responsibility are not only humans, but also living and non-living nature. Most obvious and general level, which can be a base to describe responsibility is related to somebody's responsibility for the results and consequences of his (their) actions and is called prototypical (cause oriented). The subject should be acknowledged responsible for consequences of his (their) actions, in cases, for which actions he carries responsibility. An engineer, who designed a mine, a shaft, or a tunnel carries responsibility before the management of his company, client-company, future employees of the designed facility company and local population, who live in the given territory, for technical and environmental safety, cost and reliability of this project. Very often, the issue of responsibility arises in cases of occurrence of any negative situations in implementation of the project. Rock falls in mine workings during mining of minerals can happen as a result of errors in calculations at the technical designing stage, wrong prognosis of possible mining-geological conditions of operations, use of poor quality materials for mine supporting, ignoring safety norms during mining, lack of skills, negligence and even crime. Responsibility for avoidance of errors, failure (lack of success), poor work quality etc., is the part of responsibility for somebody's actions.

Presence of responsibility as moral motivation of a social action indicates the high level of moral conscious and socialisation of a person.

Responsibility may exist as unconscious psychological complex-

es. A latent source of obeying the internal feeling of responsibility is its sacral implied sense. At the level of intuition, a person feels that responsibility is an important condition of survivability/sustainability of a society, and, consequently, of humans themselves. Irrational origin of feeling of the necessity on requirements of responsibility allows the society to preserve the boundary level of its self-preservation. The very sacral perception of life itself determines the subconscious aspiration of humans, sometimes against his/her own wishes and interests, to act responsibly in relation to the community, society as a whole [22].

Often, companies, institutions and state organs act collectively. Therefore, there exists a responsibility for institutional or corporate actions: while being not identical, they may coincide in individual responsibility of a human being, who occupies a representative position. Leader's responsibility in relation to outside addressees and subjects – is one of the examples of institutional or corporate responsibility. Responsibility for individual actions is most frequent, but if a group acts collectively, then individuals take part in joint group actions, then co-responsibility of participating members arises. Responsibility for group actions is called collective responsibility or group responsibility. It includes such types of responsibility like responsibility for a role and task, general moral responsibility and legal responsibility.

Accepting or performing a role or a task, the performer of the role usually carries responsibility for acceptable or optimal fulfilment of the task (role). Such role responsibilities can be formally prescribed or be more or less informal. They can also be legally fixed or at least have relation to the law. If the performer of a role is a representative of a corporate or institutional role unit, his responsibility can be related with corresponding responsibility of an institutional role (in case of management). In addition, there is corporate responsibility of companies, corporations, institutions for fulfilling a specific task or if they have obligations before their clients, employees of companies and community. This type of responsibility can have a legal, moral or neutral organisational nature. In addition, it can coincide with group responsibility (of group that is responsible for the company, corporation, and institution).

The next level of responsibility consists of various types of general moral responsibility. Primarily, there exists a direct moral responsibility for actions of the subject and their results in a specific situation. This responsibility is oriented to people or living creatures, or to non-living objects, whose well-being is subjected by actions of the subject (development of resource strategies, social-economic mechanisms of rational use of mineral resources, optimisation of development of mineral-resource industries). More remote consequences of activities of the subject, possibly, combined with possible impact of actions of other people or their performance, can lead to indirect moral co-responsibility. More complex problems of indirect co-responsibility arise in case of synergic or cumulative minimum sensible stimulus, for instance in case of damage of a mineral deposit irrational use of subsoil, contamination of subsoil and environment. In such cases, companies, corporations, organs of management of subsoil resources carry moral responsibility together with legal responsibility. This type of moral responsibility is indubitably different from individual moral responsibility. While not being identical, corporate moral responsibility often coincides with moral co-responsibility of the members of the organ that takes decisions. Therefore, corporate moral responsibility should not be analytically confused with the moral responsibility of the members of the group that take part in collective action or decision-making process.

H. Jonas classified two types of responsibility: natural (calling/mission) and – contractual (obligation). He also expanded the concept of responsibility by way of transition:

- from the concept of responsibility of guilty person to responsibility of the "guardian" ("Ethics of care") that became a key notion in regulation of relationships in the system of "humans-living and non-living nature";
- from calling to responsibility ex post to precaution (preventive) responsibility;
- from past time-oriented responsibility for the result of an action to future oriented self-responsibility, which is determined by the capability to manage, dispose of and control.

The responsibility taken voluntarily as a universal duty, primari-

ly assumes responsibility "for" (for instance, for future, for non-living nature, for the condition of the environment) and responsibility before everybody, and not simply accountability.

The responsibility of care that consists of ensuring well-being of a dependent person, creature, and object of non-living nature by way of specific actions in the context of general and constant obligations is closely associated with the role and is morally important. Ethical codes of various profession specialists specifically note the responsibility for safety, health and well-being of people and it is considered as having "utmost importance". This responsibility, combination of the above indirect moral responsibility and obligations to adhere to the ethical code of a specific professional community, is – at the second sublevel - also a moral obligation. Therefore, in addition to the responsibility for direct actions and results, there is higher-level moral responsibility to fulfil specific or role obligations and promises, and live in accordance with ethical standards of professional communities. This indubitably is an overall moral obligation, if fulfilment of a task, contract or a role does not contradict with the other, more important moral norm [50].

Globalisation processes are in the line of events, development of which requires immediate interference and active impact of ethical human brain. It should be possible to control and direct the way these processes flow not based on new technological discoveries, but based on ethics of responsibility, for the humanity deals with a general planetary process, the results of which will not be possible to amend. "Currently, it is the first time we are talking about taking a responsibility for possibly non-returnable consequences of collective activities of humans in science and technologies, also in politics and economy, which will change *conditio humana* in planetary scale" [5]. According to K-.O.Apel, globalisation is making the humanity face an issue that requires completely new measuring and rethinking of responsibility. Justifying the objectives of global responsibility and comparing it with forms of individual responsibility, K.-O. Apel defines the following levels of responsibility:

1. the notion of individual responsibility, classified as traditional clientele-tribal communities: obligations of loyalty to the family,

relatives and keens, friends; as per Colberg this is 3-rd degree/ stage pre-state responsibility;

2. the notion of individual responsibility, classified in all obligations in institutional frameworks of a modern country; it corresponds to professional roles of the labour distribution system that is dominant in the given society; this is the responsibility that falls in conventional degree/stage 4 ("law and order")
3. the notion of individual responsibility of post-conventional degree, which is outside the control and sanctions and is determined by own knowledge, capabilities, possibilities and is subject to human brain and conscious of a person;
4. the notion of collective responsibility of humanity for general possibility for survival of humans and for their future. This post-conventional responsibility is outside everything that may be applied to a stand-alone person; it takes the level of joint solidary responsibility for any changes, effected by the entire society (humanity). It may not be limited by obligations that are imposed by institutional rules, but can be extended to the activity of establishing such institutes and has a planetary and global nature.

For the humanity deals with events that cannot be given a reverse run, the vitality of global responsibility grows by the day. If one of the said responsibilities has traditionally been the maintaining factor of humanity, today, the priority is given to the joint and planetary responsibility. It is more important to stress the primary feature of this responsibility, because, in reality, the ethics of planetary responsibility of humanity does not yet exist, and its necessity is only proposed as a task.

The urgent need for rethinking of planetary responsibility is dictated by the speed of globalisation processes. Human history does not yet know the processes, which could change the parameters of social development in such a short historical period. Pathologies and paradoxes of global society occur in a short period; and they only seemingly correspond to such of the era of national capitalism and can be resolved using traditional methods (i.e., themselves, "by invisible hands of the market"). Such pathologies consist of the growing abyss between high tech and mineral-raw material dependent economies,

between rich (developed) and poor (undeveloped) worlds, caused by natural exclusion of those, who do not have the "exchange potential", from international exchange, which is natural to the market rules. They are the cause of destruction of social infrastructure of developed countries, the possibilities which (infrastructure) are assumed to be as a matter of course [112].

Responsibility is a moral conscious feature and criterion of law. The legal responsibility for violations and crimes, associated with use of subsoil and their useful features – is a public law instrument, which helps bringing the potential violators to responsibility for compensation of the cost of measures for elimination of the damage caused by their activity. It is intended to ensure adherence to subsoil use rules of subsoil users and government subsoil management organs, conditions and timing, compensation of damage caused to the environment, including to subsoil and third parties. There are three groups of violations in the subsoil industry: violation of subsoil ownership rights and order of subsoil use, violations of the requirement to safe performance of works, associated with subsoil use, and violations, associated with causing damage to the environment and subsoil.

The following are classified as such violations and crimes:

- unauthorised use of subsoil, including studies, exploration and development/mining of natural wealth of the continental shield of RF and exclusive economic zone of RF, conducted without due permits;
- granting licenses for subsoil use on the grounds, not envisaged in subsoil legislation;
- violation of the subsoil use order, established by subsoil legislation;
- selective (not according to design) development/mining of mineral deposits that leads to unjustified loss of mineral resources, to damage of mineral deposits and other violations of rational use of subsoil;
- violation of standards, norms and rules for safe performance of works, associated with subsoil use, protection of subsoil and environment, including violations that lead to contamination of subsoil and bring mineral deposits to a state, unfit for operations;

- violation of ownership rights for geological and other information on subsoil or its confidentiality; loss of geological information, primary geological documentation, mineral samples and core samples that are required in future geological studies of subsoil and development of mineral deposits;
- violation of rules and requirements to performance of works on geological study of subsoil that lead to unreliable assessment of explored resources of minerals or conditions for construction and operation of mines or underground erections, not associated with mining of minerals; unauthorised construction at the areas, where minerals are bedded;
- failure to ensure preservation of buildings, erections and specially protected territories and objects of environment during use of subsoil;
- elimination or damage of boreholes, drilled for the purposes of monitoring of ground water regimes, and survey and geodetic signs;
- burial of radioactive, bacteriological, chemical substances and waste in subsoil with violation of established rules
- violation of rules of delivery or sale of precious metal and precious stones to the state;
- regular violation of the order of effecting payment in use of subsoil, of tax for mining of minerals (royalties) and other payments, associated with use of subsoil;
- failure to fulfil the requirements for bringing any mine workings and boreholes to be liquidated or temporarily shut down to a state that ensures safety of population, and the requirements to safety of mineral deposits, mine workings and boreholes for duration of their temporary shut-down;
- failure to bring land areas and other natural objects, disturbed during use of subsoil, to a state, suitable for their future use.

The responsibility system in the subsoil use industry assumes unlimited financial responsibility of parties on rehabilitation of damage caused and is very important in prevention of damage to all parties, involved in subsoil use, including to non-living nature, and influences the economy by ensuring higher level measures on prevention of dam-

age to the society, living and non-living nature. Subject to the degree of social danger, size of damage caused and other circumstances, the same actions may cause both administrative and criminal responsibility.

As opposed to legal responsibility, moral responsibility is required when non-equivalent exchange situations occur, when spiritual values of moral satisfaction, avoidance of guilt, spiritual eupathy/serenity and clean conscious are offered as equivalents. Moral relations have an adjusting function for ensuring survivability of the social system in conditions of deficit of rational motivation in the activities of the members of the society.

Lack of responsibility occurs at the points of failure of the chain of determination of responsibility. Either objects of responsibility remain non-sacralised to a person or the value dispositions of such person do not assume selection of those objects that are thought to be vitally important and valuable by the society. Otherwise, we deal with a non-socialised person. Civilisations died, if lack of responsibility reached critical mass. This occurred, when the integrity of the social system collapsed, socialisation and social control and succession mechanisms did not work, failures occurred in other institutions that maintain social-moral survivability of the society. And, the first to fail were the mechanisms of sacralisation of socially important objects, which lead to extreme rationalisation of activities, which in turn, lead to failure in action of the mechanism that causes non-equivalent exchanges, including responsibility. Responsibility is associated with sacralisation of objects and relations of a certain area of its living world. This irrational event, associated with sensitive and moral nature of humans, also serves to ensure survivability of the state [22].

Today, responsibility of currently living generation before future generations is also a vital issue. We should be responsible before future generations for them to have a possibility of maintaining their life needs at least no less than modern generation. This relates to mineral-raw resources, condition of non-living nature and ecology. Responsibility requires a subject. Social medium represents an amorphous subject, therefore it is not capable of ensuring its adequate responsibility in this sense. Social responsibility of business is more specific.

8.2. SOCIAL RESPONSIBILITY IN MINING INDUSTRY

The idea of social function of capital was proposed in XIX century. In his book "General transformations of civil law from Napoleon's Code times", French lawyer L. Duguit, who was specialised in public law and practised so called social positivism method, tried to prove the necessity and usefulness of private capitalist property, and considered so called "social solidarity" as the highest principle of social and state organisation, by noting that the right directly originates from social solidarity and therefore is positioned over the state, which leads to overcoming of contradictions without revolutionary shocks. "Probably, there exists and will exist for a long time the exclusively capitalistic class, – write Duguit, – I don't see anything wrong in this… The capitalistic class is given a specific role: accumulate capitals and give them to disposal of companies. A capitalist-owner fulfils a specific social function; I deny its subjective property rights, but I admit his social duty. As long as the capitalist class continues carrying out his intended function – it will continue to exist". According to the concept of L. Duguit, private property is not a subjective law as in Napoleon's Code, it is more an obliging "social function"; therefore, we now have a widely known constitutional formula of "property obliges". As a fact/phenomenon, socially oriented business dates back to 1970'. During that decade a new concept of social contract that was mainly backed by the idea of social justice, social security and equal rights to all layers of population were actively discussed and implemented. From that time, socially responsible business became a mass phenomenon.

Experience in many countries shows that this phenomenon becomes popular only in cases of active role of the state and community in stimulation of entrepreneurs to resolve social problems.

However, much more effect may be expected from equal partnership of all social sectors in this industry from real consolidation of their efforts. It is obvious that social responsibility of business occurs and successfully develops in a socially responsible country, which in many ways depends on the development level of a civil society, which sometimes makes the state be such, controls fulfilment of this impor-

tant function by the state. In reality, this was demonstrated by the experience of developed countries of the world, who successively develop social component of the state based on the subsidiary aspect, which should be followed. The issue is in the ration of control, determination of responsibility zones of different social sectors, liaison of interests by way of seeking compromise. All this is possible only in conditions of democracy, and only when the society realises its importance, and when the state really becomes socially responsible.

Social responsibility of mining business is the responsibility of those, who make business decisions before those who are directly or indirectly affected by such decisions; this is voluntary investment of mining business into development of the society in social, economic and ecological fields; this investment is directly associated with the main activity type of mining companies and that is outside the minimum range, established by law. It is however, necessary to remember that social responsibility is not a rule, but an ethical principle, which should be applied in the process of decision making. Here the oughtness is internal, before one's self, and is based on moral norms and values, acquired in the process of socialisation.

Social responsibility of business has multi-layered feature:

1. Base level assumes fulfilment of the following obligations: timely payment of taxes, salaries, if possible – offering new jobs (expansion of staff).
2. The second level assumes ensuring adequate conditions for employees not only for work, but also for life: improvement of the level of qualification of employees, prophylaxis treatment, construction of accommodation and development of social field. This type of responsibility was conditionally called "corporate responsibility".
3. The third and highest level of responsibility assumes charity activities.

Internal social responsibility of business may include labour safety, stable salaries, maintaining significant salary sizes, additional medical and social insurance of employees, development of human resources through training programs and programs of education and improvement of qualification, rendering assistance to employees in

critical situations.

External social responsibility of business may include sponsorship and corporate charity, assistance to environmental protection, interaction with local communities and local governments/authorities, readiness to participate in critical situations, responsibility before consumers of mined mineral resources.

In the mineral-raw materials sector, business objects are mineral deposits, which have a number of specific features in this quality. For the mineral deposits are immovable property in their sense, they are located in the locations, where nature had created them. The conditions of the territories, where mineral deposits are located, are not always favourable/suitable for establishing industrial facilities. Natural geological processes that had resulted in formation of mineral deposits are complex and manifold. Therefore, actually all mineral deposits are characterised by their individual specifications of structure, quality and distribution of the mineral in subsoil and these determine the necessity in individual engineering and technology decisions at commercial development. Each mineral deposit contains a certain amount of resources, which are mined out during commercial operations, and finally the deposit stops to exist. Resource mining life is usually not long and makes about 5-10 years at small properties and up to 30-60 year at large deposits. The deposits, mining of which lasts over 60 years are very rare in the world. In comparison with other types of production activities, subsoil use is characterised by relatively high consumption of financial, material, energy and labour resources, high danger level of works and significant impact to the environment.

These specific features of mining business objects predetermined the existence of sufficiently strong inter-determining relations between economy of a mine and social field, especially at the final stage of mining of deposits or due to natural drop of the quality of ores, associated with uneven distribution of minerals, change of mine-geological conditions of mining or other natural factors (Figure 6).

Participation of mining business in resolving social problems, charity, sponsorship etc., – are primarily personal decisions of entrepreneurs, their moral issues. Nowadays, more and more mining companies in the world implement socially responsible approaches to

running their businesses that allow minimising social risks and environmental dangers while developing mineral deposits. Realising that correct social policy, healthy economy of each company and its environmental safety are important for sustainable development of society, many mining companies voluntarily take on socially responsible practices of running mining businesses.

Leading principles of social policies of such companies are based on realising of sustainable development as balanced satisfaction of current economic, environmental and social needs without damage to implementation of needs of future generations, on acknowledgment of presumption of potential danger of the activities of mining companies to the environment and priority of taking preventive measures on elimination of negative consequences of mining of minerals and use of useful features of subsoil.

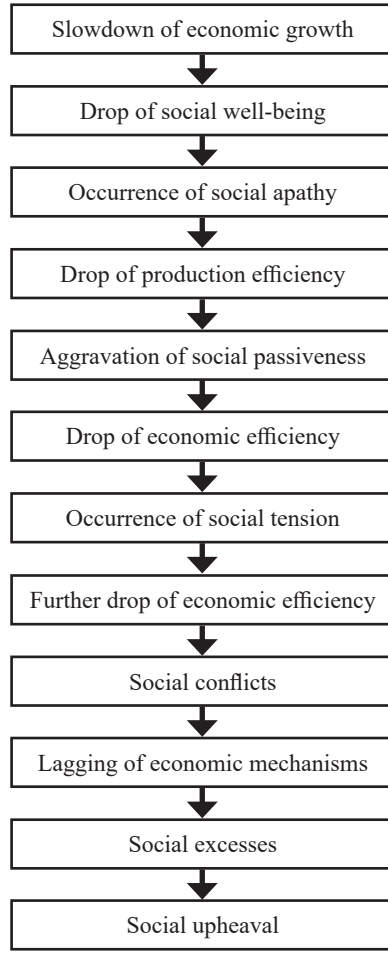

Figure 6. **Dynamics of interaction of social and economic factors in mining business** (*as per G. Gold*)

Mining companies with high social responsibility voluntarily refuse performing works in the territories with high natural values, while developing mineral deposits they build infrastructure sites by taking into account all peculiarities of natural environment (seismicity, volcanic-danger, permafrost and sloping processes, etc.), use best available technique of mining, in-

tend for maximum complete extraction of main and accessory mineral components, prefer priority of using waste as secondary raw material over its disposal, conduct constant control over safety of technological processes and monitoring of the state of the environment, and in case of any accidents, ensure soonest elimination of their consequences and cause, including rehabilitation of ecosystems and objects of fauna.

The interests and rights of local aboriginal minorities for preservation of healthy and environmentally clean nature, running a healthy way of life, cultural integrity, management of their own lands and fair compensation for use of such are mandatorily taken into account during development of mineral deposits. The local population retains the right for free, preliminary and informed consent or disagreement in relation to performing development of any mineral deposits, located in traditional territory of their habitat and use of nature, the right for joint decision making on the progress of implementation of mining projects of the relevant company. The activities of companies are open for auditing and social ecological control.

In real subsoil use practice there are examples, when companies successfully mine a mineral deposit for 8-12 years, neatly pay all respective taxes, use local labour resources at necessary levels, upon completion of mining they leave not only empty subsoil objects, disturbed landscape, but also the same economically undeveloped depressed region. For avoidance of such situations in RF, as one of the significant conditions of subsoil use, each license contains a term for mandatory signing of an agreement on social-economic partnership with local administration of the district, in the territory of which the licensed subsoil area is located.

Modern economy is a two-level differentiated system of actions with its rules and steps of the game, where moral and efficiency may be in-built conceptually at different levels and therefore, synchronously: efficiency – during stages of the game, and morals – in rules of the game. Therefore, the steps of the game are discussed from the requirements of morals, and adherence to the rules of the game is only mandatory, while competition fight actions can then be made possible to be oriented only for efficiency, and morals can be placed in the rules of the game.

Any economic activity is associated with many conflicts between these requirements and economic efficiency. For the purposes of differentiation of positive (high) and negative (low) in each case for the requirements of morals and economic profitability, K.Hommann and F. Bloe-Drese suggested the following scheme (Figure 7).

<table>
<tr><td rowspan="4">Low profitability</td><td colspan="2">High moral call</td><td rowspan="4">High economic profitability</td></tr>
<tr><td>III
Economic conflict case</td><td>I
Positive compatibility case</td></tr>
<tr><td>IV
Negative compatibility case</td><td>II
Moral conflict case</td></tr>
<tr><td colspan="2">Low moral call</td></tr>
</table>

Figure 7.**Economic activities in the field of conjugation of morals and profitability** (*as per Hamann and F. Bloome-Dresie*)

Square I represents the situation, where implementation of moral and economic targets is possible at the same time. If the mining company has a license for development of a mineral deposit, located in favourable geographic conditions and (or) which has high grades of the mineral, easy processing and recovery characteristics, favourable mine-geological and hydrogeological conditions of operation, then high rates of mining royalty in profits of the company would allow any morally desirable standards of conduct (rational use of subsoil, perform environmental protection and rehabilitation measures in full, fix high salary rates to employees and create attractive labour conditions). Moral conduct in this case becomes more independent for it assists profits or, at least, does not damage them. Personal interest from economic activities makes companies something morally desirable.

Square II represents a situation of moral conflict, when pursuing profits is followed by drop of moral requirements, when pursuing economic rationality comes into conflict with moral desires of the society. Therefore, 2007-2010 accidents in coalmines of Kemerovo oblast, which killed hundreds of lives, had one general cause – interference

of gas into control system. Gauges in mine workings were installed/ set in a way that they did not react to dangerous concentrations of methane and power shut off and working plant and equipment shut off gauges did not trigger. The workers, who were responsible for safety, did this deliberately: their salary rates were directly dependent of the amount of coal to be mined. In addition, any stoppage at any "the blast danger" would decrease the production rates, so therefore, the gauges had been reset.

Square III represents a situation, when companies can boast of high moral calls for their activities. However, in this case fulfilment of high moral requirements is associated with economic loss, which may have significant consequences in the competitive world. Thus, no economic targets of the company are achieved. If the company decides in favour of morals in a conflict situation between morals and economic profit, this decision is taken at the expense of profits (economic conflict case), in other words, any attempt to avoid moral shortfall is associated with economic insufficiencies. As opposed to Square II, when in case of a moral conflict, the company takes a decision at the expense of morals, while in Square III, having faced the dilemma between morals and profit, the company takes a decision at the expense of profits. This is a frequent situation that large town -forming mining companies have to face (Table 11).

Square IV represents a situation, when low or lack of moral call exists next to low profits or even losses. In practise, such companies have either to change self-development strategies or stop existing.

Thus, not only the intention for social stability and wish of subsoil user companies to implement the idea of sustainable development in the way of development of social responsibility, but also the fact that turned out to be economically justifiable, because the possibility of investment capital for socially responsible companies is a lot higher than for other companies; development of own employees allows not only avoiding staff fluctuation, but also attract the best professional at the market, improve labour efficiency and thus ensure stability and sustainability of company development for long term, improve the image of the company and keep social stability in the society as a whole.

For instance, mining-metallurgical company "Petropavlovsk"* has been active in building the metallurgical complex in the Far East Federal Okrug since 1994. For the past 22 years, the company had built 6 world-class mining-metallurgical combinats for mining and processing of gold ores: Pokrovsky Mine at annual production rate of 2,4 MT of ore, Pioneer – 7,2 MT, Malomyr – 1,8 MT, Albyn – 1,8 MT, Kimkano-Sutarskiy – 10 MT of ore and Olekminskiy. The company intends to double the production rate by 2015. Today, "Petropavlovsk" produces 70 % of mining of the precious metal in Amur Oblast. Owing to growth of production facilities, commissioning of new producer companies, the oblast managed to jump from position 6 to position 2 on gold production among Russian federal units.

In 2010, the "Petropavlovsk" Group commissioned the Olekminsky Mining-Processing Combinat at annual production rate of 920 000 tons of titano-ferrate and 290 000 tons of ilmenite concentrate; this was the first ferrous metallurgy company, built in Russia after perestroika and the first mine in Russia for mining and processing of ore ilmenite, which is the raw material for production of titanium. President D.A. Medvedev took part at the commissioning ceremony of this mine on July 3rd 2010. Short term plans of the "Petropavlovsk" group companies in creation of a set of ferrous metallurgy complexes in Amur river basin include designing and construction of Dalnevostochny Metallurgical Combinat and 3 infrastructure sites: trans-boundary railway bridge over the Amur River at the area of Nizhneleninskoe Village in Jewish Autonomous Oblast, the Shimanovo-Gar' railroad in Amur Oblast and port terminals at the Sovetsky Dock in Khabarovsk Krai.

The "Petropavlovsk" group of companies independently carries out geological studies and reproduction of mineral-raw bases; the group is a leader among Russian gold mining companies on amounts of investments to prospecting and exploration of mineral deposits. In 2011, the Group spent 3,1 billion Roubles into geological exploration. During the work, geological exploration divisions of "Petropavlovsk" managed to register over 149 tons of gold resources at the

* Established in 1994 by Pavel Maslovsky, Russia and Peter Hambro, England, owns licenses for geological study, exploration and mining of iron and gold ores at mineral deposits in Amur oblast and Jewish Autonomous Oblast. Social responsibility is a priority area of development of the company.

Таблица 11

List of some town forming companies (hard rock minerals)
(*Source http://ria.ru/spravka/20100201/206868955.html*)

Location of town-forming company	RU federal unit	Population, th. people	Town-forming company	Owned by
Asbest town	Sverdlovsk oblast	71.3	OAO “Uralsky Asbestoviy Mining-processing Combinat”	OAO “Uralasbest”
Gukovo town	Rostov oblast	68.0	OAO “Rosugol”	–
Dalnegorsk town	Primorski Krai	48.1	ZAO “Gornokhimicheskaya Company Bor”	ZAO “Russkaya Mining Company”
Karabash town	Chelyabinck oblast	15.8	ZAO “Karabashmed”	ZAO “Russkaya Mednaya Company”
Kovdor town	Murmansk oblast	19.5	OAO “Kovdorsky Mining –processing Combinat”	–
Kostomuksha town	Republic of Karelia	29.7	OAO “Karelsky Okatysh”	OA “Severstal”
Leninisk-Kuznetsky town	Kemerovo oblast	107.7	OAO “SUEK-Kuzbass”	OAO “SUEK”
Novokuznetsk town	Kemerovo oblast	563.8	OAO ZSMK	Evraz
Norilsk town	Krasnoyarsk Krai	105	OAO Zapolyarye Branch of MMC Norilsk Nickel	MMC Norilsk Nickel
Pikalevo town	Leningrad oblast	22.1	ZAO “BaselCement-Pikalyeva”, ZAO “Pikalevsky Cement”	ZAO “EUROCEMENT Group”, ZAO “BaselCement”
Prokopyevsk town	Kemerovo oblast	214.4	OOO “Prokopyevskugol”, “Shaft Department “Prokopyevskoe”	HC “SDS-Ugol”
Revda town	Murmansk oblast	9.4	OOO “Lovozero Mining-Processing Combinat”	
Satka town	Chelyabinsk oblast	45.7	OAO “Combinat “Magnesite””	OOO “Gruppa “Magnesite”
Svetlogorye village	Primorski Krai	1.7	OOO “Mining Combinat “Russky Wolfram”	–

state resource balance. “Petropavlovsk” is an active investor into the mining-metallurgical complex of the Far East and associated infrastructure. Investments are raised by representatives of the group at international stock exchanges in London and Hong Kong.

To-date, the company is a largest taxpayer in Amur and Jewish Autonomous Oblasts. In 2011, tax payments to all level budgets totalled in 6,5 billion Roubles (over 218 million USD). Implementation of gold mining and metallurgical projects of the company in coming years will upgrade the Amur Oblast and Jewish Autonomous Oblast to self-sustaining regions.

For the past 17 years the Group created 13 500 jobs in the Far East, while the salaries average at 30 000 Roubles, which is 1/3 times higher than the average salary rate in the Far East Federal Okrug.

The subsidiaries of “Petropavlovsk” participate in the State Programme for Assistance to Voluntary Migration of Compatriots, who live in foreign countries, to Russian Federation. Over 200 families have moved to the Far East to work at “Petropavlovsk” companies.

“Petropavlovsk” projects stimulate the growth of employment at associated industries (trade, construction, transport infrastructure, energy sector). Only construction of the Kimkano-Sutarsky MPC in Jewish Autonomous Oblast employs up to 600 employees of contractor companies of the region. Owing to commencement of shipment of the Olekminsky MPC products, the Olekma railway station managed to create new jobs, and the station class has been upgraded to class 4 level, which means pay rise to its employees. The companies purchase food, work wear and other required products from local producers.

Some training projects are implemented for the purposes of ensuring sufficient workforce for developing the mining-metallurgical industry in the Far East. In 2007, a qualification line at the Blagoveshensk State Teachers Training University was established for training of chemical-analytical specialists for laboratories of mining-metallurgical companies.

In 2011, together with the Amur State University, the Group initiated training of specialists in “Processing minerals”. In 2008, the authorities opened “Pokrovsky Mining College” in Zeya town of Amur Oblast. The college prepares specialists in 46 required qualifi-

cations. The professional orientation programme of “Think about the future!” is implemented for senior class schoolchildren and graduates of schools in the region.

“Petropavlovsk” is active in social and charity activities in the region; the group has a special Fund of supporting socially oriented programmes and projects for this purpose. In 2011, the Fund and Petropavlovsk companies rendered assistance in the amounts over 100 million Roubles. This assistance was spent to 20 children’s educational institutions, 10 medical institutions and 15 cultural institutions.

In the example of “Petropavlovsk” and many other mining companies that work in the territory of Russia, we can say that for the past decades, socially responsible mining business in its current interpretation has proven its substantiality.

8.3 ETHICAL CODES OF SCIENTISTS AND EXPERT IN GEOSCIENCES AND SUBSOIL USE

The topic of moral attitude to non-living nature at day-to-day practice of studies and subsoil use, contained mineral resources, interrelations in the process of subsoil use of Earth sciences industry scientists and professionals, who devote significant part of their life to the science, attracts special interests and attention of philosophers, psychologists, sociologists and practising specialists who try to summarise their experience in business relations in this field, correlate it with established human norms of morality and formulates main principles and rules of conduct of humans in a professional community. The system of norms and rules of a professional community that determines conduct of people is formed in ethical codes.

According to R.G. Apresyan, ethical values of the system of norms and rules of a professional community is primarily determined by their orientation to value parameters of benefit that forms the needed due, and accordingly, a system of norms and rules that determined the behavioural orientation to such values [7]. Therefore, moral regulation in the professional geological community is associated not only with the system of ethical norms and rules that reflect ethical peculiarities of interrelation of people in the process of their professional

activities, oriented to efficiency of the results of scientific studies of subsoil, practical geological exploration works and mining operations. The content of the system of ethical norms and rules in the industry of study and use of subsoil of the Earth and contained mineral resources must be determined by realising the highest value of mineral resources for civilisation, their essential peculiarities (limited amounts, exhaustibility, non-renewability and their belonging to both currently living and future generations), extreme danger to existence of humanity and low predictability of endogenic and exogenic geological processes and threats.

For the short history of geoethics, discussions have been initiated for several times on the necessity of introducing an oath for those who study and use subsoil, something similar to Hippocrates oath in medical ethics and automatically introducing the principle "Do not harm" as the main norm. In Chapter 2, we mentioned that direct mechanical inclusion of this principle into the system of "humans – living and non-living nature" relations has no sense. For even such low-damage processes to non-living nature like geological study of subsoil have serious practical purpose –finding mineral deposits that are suitable for commercial mining, and therefore, while trying to achieve this goal, some damage to certain extent is caused to non-living nature (landscapes and subsoil are changed, rocks and minerals are extracted from subsoil, geodiversity is decreased, etc.)

Therefore, ethical codes of scientists and specialists should be based on strict adherence to the geoethical imperative and not to the principle "Do not harm".

To-date there are not many ethical codes of scientists and specialists, who are active in the field of study and use of subsoil of the Earth: Ethical code of geophysicists of Russia, Deontological code of association of geologists of Spain (Annex 1), Deontological and Ethical Code of Geological Mining Association of Mozambique (Annex 2), European Code of Ethics Concerning Earthquake Predictions. Ethical codes in each narrow professional geological community (seismologists, volcanologists, geological exploration specialists, etc.) differ from each other because they are compiled in accordance with professional goals and tasks.

The key issue in the "Deontological code of the association of geologists of Spain", is the provision on acknowledging geoethics as the most important discipline of the Earth and other planets sciences; during their work each scientist and geologist must be directed by geoethical principles and act with scientific honesty, by using advanced world practices, obeying the requirement of legislation and normative-methodological documentation, keeping to the balance of the needs of society and interests of non-living nature (Annex 2).

The past few years saw natural calamities attacking us, the population of the planet Earth. Everything indeed started from the ruining tsunami on December 26th 2004 in South-East Asia, which killed about 300,000 people. In May 2008, about 9,000 people were killed as a result of an earthquake in Chinese province of Situan. In April 2010, eruption of the volcano with an unpronounceable name Eyjafjallajokull in Iceland paralysed the airlines traffic for a certain period in the whole world. In March 2011, the horrible earthquake and tsunami in Japan not only killed thousands of people, but also threatened actually the entire humanity due to the accident at the Fukushima Nuclear Power Plant.

As opposed to earthquakes, eruption of volcanoes, as a rule, do not cause many victims, but more powerful volcano eruptions may cause global cold and lack of harvest all over the world, which carries mortal threat to most people of the world. About 74 thousand years ago, a colossal eruption of Toba super volcano on the Indonesian isle of Sumatra almost resulted in extinction of human race. In addition, relatively recently, in 1783 – horrible climatic consequences of eruption of the Laki volcano in Iceland resulted in a large-scale hunger, and, as the people assume, death of 6 million people. There are about one thousand and five hundred active volcanoes on our planet, and 50 of these erupt every year. The main danger of such eruption is hidden not in flaming lava flows, but in emission of enormous amounts of ash and fast pyroclastic flows (mixture of hot volcanic gases, ash and rock debris that are thrown out of the volcano crater) and the flood flows and ruining tsunamis that follow eruptions.

Vesuvius (Naples Bay, Italy) is one of the deadliest volcanoes of the planet due to the large numbers of people living near to it. It

constantly erupted for centuries until the peak of activeness in 1944, and calmed down for a short time before the known eruption in 1979. After World War II, the people started building intensively around the volcano. By 2012, the number of people within so-called "red zone" was over 600,000 people. All these people may find themselves in serious danger at the next eruption. It is impossible to predict the scale of the next eruption, and whether the seismologists will be able to give a timely warning to population and the authorities to evacuate so many people form the risk zone. A constant monitoring is underway; however, even early precursors of coming eruption – such as uplifting of the land surface and series of small earthquakes – usually occur no earlier than two weeks before eruption. Even such indicators do not give any understanding of the form and scale, and mainly exact date/time of coming eruptions.

Humanity do not yet have the methodology of determining the date, location and scales of most of dangerous geological processes. Forecasts of any geological processes are always of probability nature.

Despite the fact that instrumental seismology has been active for over 100 years, and studies on forecasting earthquakes have been in place for only half a century, currently the researcher can sufficiently reliably give long term and mid-term forecasts: the first predicts the seismic situation for dozens of years ahead and the second forecasts – for one to 10 years; both forecast types are based on seismological and geological indicators, which slowly change upon time. On the basis of long and mid-term forecasts, scientists compile maps of general seismic regioning, which show regions with high risk of occurring earthquakes. But the scientists are not yet in the position of giving short term forecasts, similar to the known to common consumers – like: "today, we will have a cloudy day with rains and an earthquake at 5 points magnitude". For short-term forecasts, researchers use earthquake precursors, which react quickly to changes of the environment. Such precursors are, for instance, water level in boreholes, sloping of the earth surface, deformations of earth crust blocks, parameters of electrical and magnetic fields in the areas that the scientists are interested in. Scientists also conduct observations of such precursors, but only in certain regions – peculiar scientific prognostic polygons. A big

set of infrastructure is required for full analysis of earthquake precursors: buildings, equipment, servicing personnel. However, one cannot build such observation centres anywhere- for instance, towns with a lot of side noise are not suitable for such observations.

Should the population be informed about possible dangers with such level of reliability of forecasts? At the same time, constitutions of many countries determine the right of citizens for information, as one of the main requirements. Ethical codes of conducts can resolve the ethical dilemma.

Ethical codes are not legal documents, they are a call to scientists and practising professionals to behave in a certain way. Nevertheless, sometimes they may have legal consequences for those, who have violated such codes.

Questions concerning earthquake prediction were discussed at the XXII General Assembly of the European Seismological Commission held in Barcelona, Spain September 20, 1990, and at the Conference of the European Council in Strasbourg, France, October 18, 1991. This resulted in the establishment of the European Scientific Evaluation Committee for Earthquake Predictions and adoption of two general documents aimed at regulating the practice of earthquake research: Moratorium and European Code of Ethics Concerning Earthquake Predictions.

In particular, European Code of Ethics Concerning Earthquake Predictions says that if a scientist obtains data about any possible strong earthquake somewhere, he/she should not give such data to government authorities or, moreover to any mass media. Primarily, he/she should discuss the information with his/her colleagues. Only in cases, if the scientific community acknowledges the justification/certainty of the forecast, it can be given to the emergency services staff and to administration of relevant regions. “The Code” prescribes to seismologist-scientists to keep to the described order of actions even in cases, if the observation data show that the earthquake may occur in the coming few days. Based on the data from scientists, the regional authorities can make a decision to evacuate the local population.

On April 6th, 2009, a 6.3 point magnitude earthquake occurred near the town of Aquila in Abruzzo province of Italy. Some 309 peo-

ple were killed, 1500 people were wounded, 29 000 were left without homes. The damage from the earthquake was estimated to be 1.5 billion Euros. Several weeks before this, seismologist J. Juliani declared that a strong earthquake was to be expected in the area of Abruzzo. He even told the data – March 29th and showed the epicentre – Sulmonu town, located in 50 km to south-east of Aquila. Local people knew about the warnings of J. Juliani: a day before the announced date, enthusiast-volunteers drove over most of the territory of Abruzzo and notified everybody about the earthquake threat. However, people did not see the promised earthquake on March 29th, and J. Juliani himself was almost jailed; at a special out-of-office meeting of the Committee for Large Scale threat to safety, the head of the Agency for Protection of Civil Population (analogue of Russian Emergency Services), G. Bertolaso called to local population to calm down, and angrily called Juliani – guilty of all mess "a bonehead, panic monger". [130].

G. Bertolaso's announcement was based on an opinion of six outstanding Italian seismologist-scientists*: insignificant quakes, observed in Aquila for the past days, did not predetermine a more serious earthquake. In addition, at the press conference, the specialists mentioned that it is not possible to predict whether an earthquake would take place or not.

The ruining earthquake in Aquila occurred in six days after this optimistic forecast. In addition, the six Italian scientists, who erroneously assessed possible risks and one government officer were sued and in 2012 were sentenced to 6 years of prison each.

The Italian society was divided into two camps. Over 5000 scientists signed an open letter to the President of Italy Giorgio Napolitano, where, inter alia, they indicated that at current level of development of science, even at short terms, it is impossible to predict the time, exact location and strength of any earthquake. The head of the organisation "309 martyrs" doctor Vincenzo Vittarini, who had lost his wife and daughter in April 2009, said: "Nobody expected the exact date. We would simply want to be warned about the fact that people are sat on a bomb" and "I hope that such court case will lead to the case when

* Including ex-president of National Institute o Geophysics and Volcano Studies (INGV) Enzo Bosie, professor of physics at the University of Genoa, Claudio Eva

more attention will be given to distribution of information about the risks"*.

Many scientists think that announcing a coming danger of an earthquake is an extreme measure and we should not use it preventively – which, those, who think the Italian scientists should be punished, are talking about, because we would have to evacuate sick people as well as infants. Some of them may die on the way. And what then? Will the scientists have to be brought to court? Supporters of this point of view say that it is not necessary to announce forecasts for prevention of human deaths for currently forecasts may not be reliable, and we would better build buildings by taking into account the magnitude of future underground quakes. In addition, it is necessary to assess the wear of already build buildings and fortify them if possible.

It is also necessary to work with local population – educate people, tell them how to behave during underground quakes, carry out training courses. In this case, there will be much less victims.

In November 2014, the Appeals Court of Aquila in Italy excused the six scientists and the government official, who had been imprisoned in 2012 for the error in assessing the seismic situations that resulted in human deaths and ruins. But the relatives of those, killed by the earthquake are still continuing the court battle.

This extensive court proceeding in Italy is really a precedent and can cause different consequences. Accusation of scientists, even if they have been excused eventually, can lead to the case, when prediction of an earthquake will become an unpopular scientific field, while any experts' assessment as a whole will be a more thankless task. The court also (in unclear forms) indicates the issues, which all direct democracies will have to face. This limited competence of majority of participants and deficit of efficient methodologies of proof of expert competence to the society by experts themselves

In this case, ethical codes of scientists and professionals in the

* We should note that National Institute of Geophysics and Volcano Studies (INGV) have for several year been making open publications of seismic danger maps. And when in 2010, some rumour spread in Rome about a possible earthquake, the Institute staff accepted people 24 hours a day demonstrating readings of seismic meters and explaining actual state of subsoil in commonly comprehensive language, and making available all necessary information fro any willing in the mode of remote access via their website.

Earth sciences field, despite its lack of perfection, allows creation and maintaining high standards of ethical conduct in relation to non-living nature and in forecasting geological catastrophes.

Analysing the ethical collisions of "Aquila case", the founder of geoethics Doctor V. Nemec proposes the following geoethical steps for minimisation of all kinds of risks in prediction of geological catastrophes:

a) a new legal interpretation of "false alarms" and reasonable risk and danger levels is to be established (up-dating internationally acceptable definitions and protection measures);

b) any positive prediction for any known real natural disaster (whoever made it) is to be precisely analysed by competent institutes avoiding any underestimation of "incompetent" researchers and amateurs and respecting diversity of scientific research "schools";

c) a reciprocal respect between scientists and the population is to be based on the use of a reciprocally understandable language;

d) scientists as well as media are obliged to respect and publish the complete truth about facts with clearly defined words to avoid any misinterpretation of results;

e) consequences of relatively "minor" earthquakes are no more limited only to an adjacent local area;

f) the appropriate programs for computerized predictions are to be under a permanent control of validity (using alternative parameters and incorporating verified or supposed time-tables of events from the past);

g) any scientist when accepting a function in a State organ has to accept his role with high personal responsibility for and respect to the goals, work and results of such a commission;

h) any effective prevention of the population is to be based on a mutual consensus preferring in any stage the common good instead of particular or personal interests and respecting human lives as the top value priority[115].

CONCLUSION

Current world population is more than 7 bn people. No other species that have ever lived on our planet made such a great impact as humans: we have inhabited all continents, changed the surface of Earth, and partially its atmosphere, hydrosphere and biosphere. Our place in natural hierarchy was not always like this. Our predecessors had to fight for one's place in the sun.

Nowadays humanity moved quite far from having to fight for its biological existence. With each next generation destiny of humans is more and more defined by ethical evolution not only within the system of human relationships, but also within the system "human-planet Earth and its resources".

In its geoethical development humanity went through many stages – idolization, learning, fighting, and conquering. Since the time when humans became fully aware of themselves as species and until the 19th century, they consciously adhered and believed in the cult of Earth and worshiped it. In the 19th century humans' perspective significantly widened to reach the limits of our universe. And by now people have become a planetary power. This power can leave everything as is, but can also cause death of all biological life and potentially destroy Earth as a planetary body.

After conquering nature the next most likely step is redemption. The result of human's life so far is realisation of how unique planet Earth is, its mantle, surface and resources. Understanding of incredible importance of its subsoils and objective need to explore and exploit them rationally for our existence is the main objective of geoethical evolution.

Geoethical ideas, ideals and rationales are not silly phantasies of idle mind that are unnecessary for our existence. Their objective is to save our civilisation from self-destruction. Our technological civilisation does not quite see or feel its limits yet. The real threat lies

in never ending unjustified technological development that requires exploitation of larger quantities and more diverse resources especially mineral ones.

Countries with rich mineral resources face unique opportunities and unique problems. If used rationally, abundance and wealth of mineral resources creates an environment where current and future generations can prosper. However unreasonable and irrational exploitation of mineral resources creates economic instability, social conflicts and irretrievable ecological losses.

Geological research, exploration, mining of mineral resources and exploitation of subsoil's useful qualities should not be economy's goal in itself. Access to mineral wealth and natural resources should be helping countries to solve social problems. For some nations the best way to manage their mineral resources is to actually leave them in the subsoils for future exploration, for others on the contrary it is best to mine and process them as soon as possible to create means for supporting investments required to satisfy urgent social needs. In both cases, the countries with economies dependent on natural resources must maximise opportunities arising from subsoil's wealth for their social and economic development.

Moral responsibility for rational use of mineral resources for the benefit of all people lies not only with governments of those countries on which territories these mineral resources are, but also with inter-governmental bodies, governments of importing these mineral resources countries, mining companies (including international ones), various social groups, scientists and experts in Earth science and subsoil use.

Presenting to the readers a new scientific discipline we tried to evaluate the need and relevance of ethical approach to solving problems created by exploitation and use of mineral resources. Such problems arise from combination of geo-scientific issues, such as uneven geographical distribution of mineral resources, their exhaustibility and finiteness, natural geological and industrial risks by extraction of mineral resources and their useful properties, as well as preservation of geo-diversity and ethical issues, such as resource belonging to future generations, responsibility when making decisions, and fair distribu-

tion of profits from subsoil use.

Geoethics help to identify problems, values and purposes of subsoil management. What exactly are we doing and does it correspond with what we are aiming to achieve in reality? Geoethics assist in formulating possible and preferable solutions. Sometimes in a way of only revealing the dilemmas. Geoethical analysis allows to form the basis for preparing and making important decisions. In our pursuit of right behaviour it is necessary to strive to act fairly towards wildlife as well as inanimate objects of nature. Our actions, on one hand, are bound by responsibilities, and on the other hand allow us to discover new areas for research, and open new opportunities.

Annex 1

SPANISH OFFICIAL ASSOCIATION OF GEOLOGISTS (ICOG) DEONTOLOGICAL CODE

Approved by the Ordinary General Assembly of ICOG, held on April 9, 2011

PREAMBLE

The social function of Geology requires establishing ethical standards that help define clearly the desirable ethical conduct of their professional and avoid unwanted behavior.

Geology is a profession that requires scientific and technical knowledge, experience and judgment to practice and serves both private and public interest.

The geologist has a professional responsibility to the client, his colleagues and the professional association, which must be exercised ethically. In addition, the performance of their profession can have a big impact on society, the environment and public planning. Therefore, it is necessary to ensure that their decisions are consistent with the general interest, customer and everything related to safety, health protection, geoethics and sustainability.

The performance of Geologists must be guided by the principles of social responsibility, integrity and professional independence, personal dignity, truthfulness, loyalty and diligence.

According to Article 5.I) of the Law of Professional Associations, Professional Associations have the duty to ensure ethics and professional dignity, and respect the rights of citizens. It corresponds to the Official Association of Geologists (ICOG) the establishment of the ethics framework in which to practice the profession of geologist, thus fulfilling a vital role schoolboy, both domestically and in the protection of the interests of consumers and users of the services of the members. All in accordance Code of Ethics, adopted in June 2010 by the Council of the European Federation of Geologists.

The statutes contain, in Article 83, a catalog of breaches of corporate duties, called to be complemented with this Deontological

Code, which generally incorporates the principles that should govern the exercise of the profession and the specific standards of behavior and performance derivatives from them.

However, the purpose of the rules contained in this Code is not punitive but preventive, in that they show guidelines of conduct to bring Geologists to the concept of excellence of the professional association, and the exercise of the social function that profession aims.

Violations of these rules may lead to disciplinary responsibility in the terms provided in the Articles of Association of Geologists and other regulations that develop them.

ARTICLE 1. DEFINITION AND SCOPE

1. The geological ethics is the set of principles and ethical standards that should inspire the professional conduct of the Geologist.

2. The duties imposed by this Code and those established in the Statutes of ICOG and other regulations that implement, require all Geologists in the exercise of their profession, whatever the mode in exercising function or position to play. Also, these duties extend to the Professional Societies registered ICOG, without prejudice to other collegiate regulations.

3. Failure to comply with the principles and rules of this Code of Ethics constitute a disciplinary offense as provided in the Statute of ICOG, and will be sanctioned prior determination of the responsibility of the referee in accordance with the procedure provided for in Laws, Regulations Internal Rules and the Rules of Procedure Sanctioning.

4. The ICOG assumes the development and constant updating of professional ethical standards, minding its dissemination and forcing himself to enforce them.

ARTICLE 2. ETHICAL AND ETHICAL OBLIGATIONS

1. The Geologist adjust its professional conduct to basic ethical principles of social responsibility, integrity and professional independence, personal dignity, truthfulness, loyalty and diligence as well as collegiate standards.

2. The geologist must take into account at all times the social

role.

3. The Geological use their knowledge and skills to improve the collective welfare of citizens and environmental protection, guided by the general interest.

4. The Geologist perform its activity in the areas of competence.

5. The Geologist exercise their profession independently and prevent its performance would be affected by interests contrary to their good professional according to the state of science and technology, their ethical commitments and their duties of loyalty.

6. The Geologist will strive to make their professional standards compatible with the desires and expectations of its customers and society.

7. The Geologist apply their experience and knowledge, theoretical and practical, to do their work.

8. The Geologist prevent misleading actions and any practices that may generate mistrust about the veracity of their professional activities or may erode the public image of the profession of geologist.

9. The geologist must always act in accordance with the law and the rules governing the exercise of the profession.

ARTICLE 3. COMMITMENTS TO SOCIETY

1. The Geologist always seek to preserve and protect the safety, well-being of society and the fundamental rights of citizens, in areas that affect the charge that his charge.

2. The Geologist will carry out its task taking into account the basic standards of safety and health at work, basing their decisions on technical criteria, depending on the state of science.

3. The Geologist respect the values upheld by the legislation on protection of personal data. Consequently, you can not apply or use personal data obtained in the development of their professional practice for different purposes that motivated their knowledge and treatment, or sell them to others without the express prior consent of the holders of such data.

4. The Geologist must have professional liability cover, according to the risks of the profession, activity and assumed orders.

ARTICLE 4. COMMITMENTS TO GEOETHICS

1. The geoethics is a key discipline in the field of Earth Sciences and Planetary Sciences, which involves different aspects of scientific, technological, methodological and socio-cultural character. To fulfill the geoethical principles, the geologist must act with scientific integrity, good practices and appropriate protocols, maintaining appropriate attitudes to a balanced relationship between the practice of Geology and abiotic components of the world.

2. The Geologist is obliged to be aware of the importance of scientific and technical progress for humanity, and their social responsibilities in the performance of professional activity. These advances open up possibilities make incremental progress, but may also involve risks and ethical dilemmas that have to be considered.

3. The Geologist is obliged to ensure economic and social development that meets the needs of the present without compromising the ability of future generations, and will seek to maintain a global and integrated approach in solving problems affecting the planet Earth. To do this, you should consider in their actions the rational use of natural resources and the demands of society regarding the environment, avoiding the transfer of undesirable products to the natural environment and bearing in mind the principles of sustainability and caution.

4. The Geologist will consider the ethical requirements of protection of geodiversity and geological heritage. To this end, reconnaissance activities and materials research and geological processes, endeavor to preserve rocks or outcrops that may involve a single record of the processes occurring in nature.

5. The Geologist bring all their knowledge and capabilities in mitigating natural hazards, giving priority to preventive strategies, and seek to ensure the safety of people and goods as well as environmental protection. When required, cooperate responsibly and diligently with the public authorities in risk situations and, where appropriate, assist in the transmission of information to society, using with seriousness, objectivity and rigor of scientific data.

6. The Geologist assess the determining role of geological factors in the fight against poverty and, where appropriate, will contribute its expertise to the sustainable improvement of the living conditions of

the most vulnerable societies.

ARTICLE 5. PERMANENT EDUCATION

1. The Geologist constantly updated training, incorporating new scientific and technical knowledge to occur and including, where necessary, the use of new technologies. It will

keep up to date on new developments professionals, in order to maintain safe and effective practice. In no event accept orders for those who are not properly trained.

2. The Professional Organization will develop in accordance with its Statutes, the capacity of technical and professional evaluation of all cases where a technical certification of professional competence of the members needed. It will also seek to disseminate among Geologists new discoveries, advances and developments that may affect the proper professional practice.

3. The Geologist could not be attributed academic degree, professional or merit of any kind of lacking.

ARTICLE 6. PROFESSIONAL ACTIVITY

1. The term professional activity specified in Article 21 of the Statute of ICOG, approved by Royal Decree 1378/2001, of December 7.

2. The Geologist must behave with honesty and diligence throughout performance. It will seek to prevent potential risks to health, people, property and the environment, and develop their work with due skill and quality, according to the state of science and technology.

3. No need to accept greater number of orders that can respond appropriately. It shall exercise caution delegation of authority, without transfer of their professional duties who is not technical or legally qualified to carry them out. It will not sign any document that has not been prepared or reviewed by it and be responsible for any anomalies that may occur in the reports produced.

4. Have the right and duty of full independence of judgment and fairness in the conduct of their professional activity, against interference, own or other interests, pressures, demands or complacency, avoiding

any prejudice that might undermine their objectivity.

5. Will act in a spirit of collaboration and participation in the powers that could be shared, contributing loyally with their knowledge and experience in the exchange of technical information with other professionals who may be involved in its work, in order to obtain at all times the maximum effectiveness in working together.

6. Refrain from giving professional coverage to those actions that do not come countersigned by the corresponding qualifications or legal authorization and can be therefore cases of professional intrusion.

7. Geologists can not procure professional work through prohibited by the legislation on free and fair competition practices. Neither you can accept a professional job facilitating, assisting or collaborating in any way with the client in carrying out any actions which constitute a breach of applicable law.

8. Without prejudice to the liberalizing measures and professional services fees, can not determine the amount of their professional fees in unfair competition with other colleges and, in any case, shall not set them below cost for a while, pretending to convince the customer that normal fees of other colleges are excessive and produce windfall profits; or pretending to discredit the image of other colleagues; or looking for a strategy aimed

at eliminating a competitor or group of competitors from the market. However, it may fix the amount of their fees if the program to be developed is seen as a requirement for the development of their professional activity.

Geologists can not market to prevail in the competitive advantage gained by the violation of laws.

9. Maintain the confidentiality of all data, facts or any confidential information which has agreed under their professional work.

ARTICLE 7. RELATION TO PROFESSIONAL ASSOCIATION

The geologist is obliged to:

1. Comply with the provisions of the Statutes, Regulations and Circulars of the Professional Association, as well as other rules governing the exercise of the profession, and the agreements and decisions of the collegial government bodies.

2. Respect governing bodies and members that compose them when they intervene in such quality it should meet with the utmost care communications from such bodies or their members in the exercise of their functions.

3. Contribute to maintaining collegial loads and other financial obligations under the Articles of Association, in the manner and time have been set.

4. Avoid generation of damage affecting the image or heritage of the College, its organs or of the members.

5. To inform the Professional Association any act of professional intrusion, as well as cases of illegal practice, be suspended or disqualified by the defendant, and all the performance that contravenes the ethical standards of the profession. This duty extends to the misuse of the name "Geologist" by people who do not have that quality.

6. To inform the Professional Association grievances or inconsideration that he and one of his companions had been during or as a result of professional practice.

To inform the Professional Association of the situations in which third parties will be urging or requiring unethical or unfair behavior with the profession, the environment or society.

7. Communicate to the Professional Association for the fulfillment of its purposes and the exercise of their functions, personal circumstances affecting professional practice, such as personnel changes address, bank debit payments, account number or your office headquarters professional.

8. To provide collaboration governing bodies to be required, unless there is just cause to prevent it.

9. To appear before the Deontological Committee when they were required for this.

10. In the case of members of the governing bodies of the Professional Association, keep the confidentiality of deliberations within these bodies, as provided in the Constitution and rules of operation of these bodies.

Members of the governing bodies and the candidates to them, treat the personal data to which they have access as a result of the performance of their duties or their participation in electoral

procedures, in accordance with the rules of protection personal data and, in any case, they can not apply the personal data pair purposes other than those for which they were understanding and treatment, or transfer them to others.

11. The referee act representing the profession in their own institutions, as well as juries, commissions, tribunals, or any other bodies or forums should take care to have due knowledge of the issues to be dealt with, being informed of with prior notice and with the greatest possible extent, so that their performance is always in line with his representation, supporting its discretion in sufficient reasons to justify.

12. The referee occupying positions in the governing bodies shall observe the utmost rigor and demand in fulfilling their duties. It is obliged not only to adjust their behavior to the statutory and ethical standards, but to set an example in all its actions to the rest of the members, and to promote the common interest of the Professional Association and the profession. It will also ensure that all nurses have the relevant college information. It will facilitate timely and the means to the same employment opportunities to all nurses, and refrain from using their own professional situation elected to benefit.

ARTICLE 8. RELATIONS BETWEEN GEOLOGISTS

1. The Geologist must maintain mutual loyalty, mutual respect and partnership relations.

2. The Geologist build their professional reputation on its own merits, avoid disseminating information capable of determining the discrediting of a partner and not compete unfairly with other geologists. Nor will induce or advise others to act improperly or unfairly against their peers.

3. The Geologist should be objective in criticizing the work of colleagues, always acting with due discretion. He accepted from peers and colleagues honest and objective criticism, and make, in turn, when necessary.

4. The Geologist who intends to exercise a civil or criminal action in its own name, against another partner, regarding facts connected with his professional activity, must inform the school so that, if both

agree, to exercise the mediation efforts.

5. The senior Geologist in the practice should disinterestedly provide guidance, advice and guidance comprehensive and effective younger who request mode.

6. The Geologist should not resort to a third party in order to circumvent the limits of the law for money or profit. Reciprocally should not allow his name to be used for the same purpose.

7. The Geologist must avoid unfair substitution of another geologist in professional practice. The Geologist, in case it is called to act in an activity previously committed to

another, shall inform the person concerned and make their best efforts for the outgoing referee has satisfied in their professional fees and other rights.

8. In the expert opinions, the Geologist maintain the utmost personal respect the partner of the opposing party or the author of the work that professional expertise relates, avoiding any kind of subjective disqualification and sticking to the technical aspects of the matter at issue . It should be limited to issuing opinions of strict technical nature.

9. The Geologist in his professional activity shall recognize and respect the rights of intellectual property. You shall have the right, either personally or in collaboration, to recognize him as their own work, without any other attributable as those of his other than the author.

ARTICLE 9. CUSTOMER RELATIONS

1. The relationship with the customer Geologist must be based on mutual trust. This relationship can be facilitated by signing the Order Form Professional Services or a similar contractual document.

2. The Geologist is obliged to act on behalf of his client, respecting the principle of social responsibility applying independently and according to their knowledge, best practices and appropriate measures to ensure compliance with the objectives of its technical customer.

The principle of independence allows you to refuse the instructions, against their own professional standards or applicable law, seek to impose the client, professional or any other person to

work or even on which he depends.

3. In accordance with Article 24 of the Statute of ICOG, the Geologist maintain the confidentiality of the information received in the execution of their orders and shall not, without the consent of the client, the documents obtained as a result of the development of their professional activity. Except injunction, geologists can not use the information available your client to the detriment of the latter.

4. The Geologist will be free to accept or reject the case which prompted his action without express the reasons for their intervention, except in cases of judicial appointment or appointment as an expert by trade, in particular laid down, in which it must justify its decline.

It may abstain or to cease acting when discrepancies arise with customers. In any case, you must not accept an assignment that can not cater for having committed the realization of other professional jobs.

5. The Geologist shall inform the customer of the actual limits of its performance, the results that can be obtained, the approximate amount or the basis for its determination and the evolution of the entrusted activity.

6. The Geologist not assume the role of technical adviser of trade disputes interested in one of their regular customers who have already expressed their opinion.

7. The Geologist dependent entities providing a public service, refrain from unlawful use of means and prerogatives inherent in his position, both for their own benefit and third. Also, it refrains from take advantage of its position to harm or benefit third parties.

8. The Geologist is obliged to carry through in their entirety professional work entrusted, unless there is just cause or force majeure.

9. The Geologist avoid negligent actions on their performance, especially with them harms the interests of the client.

10. The Geologist accept the objective existence of facts or technical or scientific irrespective of valuation data to the client.

11. The Geologist may not accept professional assignments involving proceedings against a former client, when there is a risk that the confidentiality of the information obtained in the performance with the former client may be violated or that these could be benefit to

the new customer .

12. The Geologist may not retain or use the documentation that was provided by the client as leverage to collect the outstanding fees.

13. The Geologist renounce an already begun performance, execute all acts necessary in order to avoid damage to the client or potential loss of benefits or rights, prior to termination.

ARTICLE 10. OF CONFLICTS AND CONFLICTS OF INTEREST

1. The Geologist must comply with the legal regulations regarding incompatibilities and therefore can not accept an assignment or professional work for which development is incompatible under law or regulation, or by resolution of the competent body whose.

Also, the Geologist accept no custom in which there is possibility of conflict or clash of interests and, in any case, shall take appropriate measures to avoid such a conflict, if it occurs after, if necessary, to give up the request.

2. In any case, the referee shall not accept commissions or professional work in the following cases:

a) When are objective or subjective conditions that endanger their independence of judgment and proceed straight.

b) When occurs or impairment of prestige or dignity of the profession may occur.

c) When there is a possibility of collision of interests that may put the referee in equivocal situation, a circumstance that always concur that same performance is involved simultaneously playing the functions of the profession and involving another profession or academic qualifications.

d) When instead be given to a situation of unfair competition with other colleagues.

e) When should inform, assess, inspect, monitor, rate, or act professionally in Juries, Commissions, Tribunals and Surveys, depending on what determines current legislation and conflict of interest is given.

2. The referee who concur in any way affiliated with the Public Administration, or companies or companies that provide a public

service, refrain from unlawful use of means, facilities or privileges inherent in his position or situation, both for their own benefit and third. Also, it refrains from take advantage of their position to harm or benefit third parties.

ARTICLE 11. THE PRACTICE THROUGH A PROFESSIONAL COMPANY

1. Geologists may associate to practice under the terms established in the Law 2/2007 of March 5th, Professional Societies and development rules, respecting prevented in collegial legislation on the subject and this Code.

2. Geologists act within a professional society professional activity exercised in accordance with the proper ethics of the profession regime with the regulations of the professional duties of the same and with the statutory and regulatory provisions applicable, without prejudice to the rules of the business organization to which it belongs. In no event shall preclude the exercise of the profession through a professional society for effective implementation of Geologists, partners or not, the disciplinary system appropriate to the professional system.

3. Geologists who have the status of legal representatives of a professional society are obliged to promote the registration thereof in the Commercial Register. If, for reasons beyond their control, such registration does not occur, they must in any event communicate to the College the existence of society and provide accurate data for knowledge of it you have. This obligation of registration and communication reaches the first registration and any amendments to the bylaws are made.

4. Geologists may not hold the status of professional partners in professional societies involving other partners whose professional activity has been declared incompatible with the exercise of the profession.

5. Geologists must ensure that the professional society no conflicts of interest, and if it occurs after, should take appropriate measures to overcome it, must, otherwise, renounce the request.

6. Geologists must refrain from exercising through a professional society or is not aware if it maintains contracted sufficient to cover

the liability of which the company may incur safe, all in the manner prescribed by law applicable, which is without prejudice to the liability insurance that might have collegiate own, voluntarily and by law.

7. Geologists must refrain from using professional society so that they are committed to the principles of technical independence or proper identification of the professional, in any case must ensure proper delimitation of professional skills, respect for the principles of independence and professional identity and, ultimately, the right exercise, within society, the profession.

ARTICLE 12. FEES

1. The Geologist is entitled to financial compensation or fees for their performance, and reimbursement of expenses that have caused the performance.

2. The Geologist may freely adjust the amount and rate of the fees agreed with his client regardless of the guidance ICOG fees.

3. The fees must be received by the Geologist bearing the address and effective implementation of the matter and can handle the ICOG, if you so desire, collection management thereof with the consequent percentage consideration.

4. The Geologist is entitled to request, prior to the start of a performance, payments on account of fees and expenses.

5. Infringements constitutes ethical behavior geologist repeatedly attempt to collect fees that have been challenged or complaints from justified on the grounds of its excessive amount.

FINAL PROVISION ENTRY INTO FORCE

This Deontological Code, once approved by the General Assembly ICOG be published for general knowledge of the members in the first newsletter you edit, as well as on the website of the College the day after its approval, and enter into force on 1 May 2011.

GEOLOGICAL MINING ASSOCIATION OF MOZAMBIQUE DEONTOLOGICAL AND ETHICAL CODE

PREAMBLE

The development of the geological sciences in Mozambique, of the knowledge of the geology and of the mining sector of the country, together with the growing number of professionals, and the lack of a reference standard of conduct for professionals, leads to less agreeable situations occurring in the performance the various professions related to the Geosciences.

It is unquestionable that Geosciences have a crucial social role, since the professionals are required tot have scientific and technical knowledge, experience and judgment capacity to serve both the public and the private sectors. This social role requires the setting of ethical standards that help to clearly define the desirable ethical conduct for the professionals.

The Professional of Geosciences, hereinafter referred to as Geoscientist, has a professional responsibility in relation to the client, his colleagues and the society to which he/she belongs, which should be ethically and clearly exercised. Moreover, his work will have a major impact on society, environment and spatial planning. Therefore, he/she is obliged to ensure that his/her decisions are consistent with the general interest of the client and with all that refers to safety, health protection, geoethics and sustainability.

The activity of Geoscientists should be governed by principles of social responsibility, integrity and professional independence, personal dignity, truthfulness, loyalty and diligence.

It is up to the Mining Geological Association of Mozambique (AGMM) the definition of deontological standards in which the profession of Geoscientist must be exercised, and it is in this sense that Deontological end Ethical Code is adopted, and ahead defined.

The Code is not intended to be punitive, but preventive, through guidelines of professional conduct to approach the Geoscientist to the concept of excellence and true social function that the profession

requires. Although not be punitive, bad professional performances may be subject to prosecution under the law in force in the Republic of Mozambique.

Article 1. General Principles

1. The geological deontology is a set of principles and ethical standards that should inspire the professional conduct of the Geoscientist.

2. The Geoscientist is morally obliged to follow this code of ethics and professional conduct, whether or not a member of the AGMM.

3. All professionals subject to this Code shall, in the exercise of their profession, be based on the criteria and spirit of the following rules, in order not to bring harm to the professional dignity.

4. The privilege of exercising any of the professions of Earth Sciences requires the highest standards of honesty, morality, professional conscience and professional moral responsibility.

5. The Geoscientist is responsible for the brand image that he/she gives the profession next to the public and the society.

6. The Geoscientist is subject to maintain confidentiality under the law in force and the commitments to third parties.

Article 2. Ethical and Deontological Obligations

1. The Geoscientist shall exercise his/her professional conduct in accordance with the basic ethical principles of social responsibility, integrity and professional independence, professional dignity, truth, loyalty and diligence.

2. The Geoscientist must always take into account the social role he/she plays.

3. The Geoscientist will use his/her knowledge and skills to improve the collective welfare of the citizens and the protection of the environment, guided by the public interest.

4. The Geoscientist shall perform his/her activities in the areas of his/her competence.

5. The Geoscientist shall exercise their professional activity with independence, preventing his/her activity to be conditioned by contrary interests to his/her good professional performance, according

to the state of science and technology, to his/her ethical commitments and his/her duties of loyalty.

6. The Geoscientist shall seek to make his/her professional criteria compatible with the desires and expectations of his/her clients and the society, using all his/her experience and knowledge (theoretical and practical) to carry out his/her work.

7. The Geoscientist will avoid making misleading actions and any practices that may lead to suspicion about the consistency of his/her professional competences, or that can erode the public image of his/her profession.

8. The Geoscientist must always act in accordance with the established law and rules governing his/her profession.

9. The Geoscientist can not avail themselves of academic, professional or merit titles.

Article 3. Commitments to the Society

1. The Geoscientist should have his/her professional liability insured, in accordance with the risks of the profession, its activity and assumed charges.

2. The Geoscientist will always seek to preserve and protect the safety, the well-being of society and the fundamental rights of citizens in activity areas related to the works to be developed .

3. The Geoscientist will carry out his/her mission under light of the basic rules on environment, work health and safety, basing his/her decisions on technical criteria, according to the state of Science.

4. The Geoscientist will respect the values endorsed by the legislation on protection of data of professional nature. As a consequence, he/she cannot neither apply or use personal data obtained in the course of his/her business for purposes other than those that led to his/her attention and treatment, nor can he assign them to third parties without the prior written consent of the owners of such data.

5. The Geoscientist shall have his/her professional liability insured, in accordance with the risks of the profession, his/her activity and charges incurred.

Article 4. Commitments to Geoethics

1. Geoethics is a key discipline in the field of Geosciences, which takes into account various aspects of scientific, technological, methodological and socio-cultural character. In fulfilling geoethical principles, the Geoscientist must act with scientific integrity, good practice and appropriate protocols, maintaining appropriate attitudes to enable a balanced relationship between the practice of Geosciences and the components of the abiotic world.

2. The Geoscientist has the obligation to be aware of the importance for Humanity, of the scientific and technical advances, and of his/her social responsibilities in performing his/her professional activity. These advances open doors both to major advances, and may lead to risks and dilemmas that have to be considered.

3. The Geoscientist is required to ensure economic and social development that meets present needs without jeopardizing the capacity of development of future generations, seeking to maintain a comprehensive and integrated vision in solving problems affecting the planet. For that he/she must take account the rational utilization of natural resources and the demands of society on the environment issues, avoiding the transfer of undesirable products to the natural environment and bearing in mind the principles of sustainability and prudence.

4. The Geoscientist should take into account the ethical requirements for the protection of geodiversity and geological heritage. For this reason, during his/her fieldwork activities, he/she will seek to preserve rocks, minerals, fossils, outcrops, archaeological remains and other objects that could be a single register of natural processes.

5. The Geoscientist will use all his/her knowledge and skills in mitigating natural hazards, giving priority to preventive strategies, while ensuring the safety of persons and property, as well as the protection of the environment. When necessary, he/she will responsibly and diligently cooperate with the relevant public authorities in critical situations, collaborating in the transmitting information to the society, using the data with seriousness, objectivity and scientific rigor.

Article 5. Continuous Education

1. The Geoscientist will seek, within the existing possibilities around him, to continually update his/her education through the acquisition of new scientific and technological knowledge that is constantly appearing. He/She should seek to keep updated on the professional news as they come up s, in order to maintain his/her work updated, safe, effective and efficient. Under no circumstances the Geoscientist must accept any job for which he/she is not properly trained.

Article 6. Professional Activity

1. The Geoscientist must behave with honesty and diligence in his/her entire professional career. He/She will seek to prevent possible risks for health, people, property and environment, and to carry out his/her work with due skill and quality, according to the state of science and technology.

2. The Geoscientist shall have all the care needed to delegate competences, not giving them to those who are not available or technically and legally qualified. He/She shall not sign any document that has not been carefully revised by him/herself, and will be responsible for any error or anomaly that is found therein.

3. The Geoscientist has the right and duty to a complete independence and impartiality of discretion in his/her professional activity, with regard to possible interference, own or other interests, pressures, demands or complacencies, avoiding any situation that may condition his/her objectivity.

4. The Geoscientist should act with a spirit of collaboration and participation in tasks that may be shared, contributing with his/her knowledge and experience for the exchange of scientific and technical information with other professionals who may be involved in his/her work, with the aim of always obtaining maximum effectiveness and efficiency from a joint work.

5. The Geoscientist shall refrain from giving coverage to professional activities which are not included in his/her corresponding title, which may constitute interference assumptions in the professional activities of others.

6. The Geoscientist shall not accept any working professional work that facilitates, assessors or collaborates with the client in performing any activity that goes against the laws and regulations in force.

7. The Geoscientist will maintain confidentiality of all data, documents or any other information of reserved character to which he/she had access during his/her professional activity.

Article 7. Relationships with Geoscientists and other Professionals

1. The Geoscientist shall maintain mutual loyalty, mutual respect and relationships of companionship.

2. The Geoscientist should base its professional reputation on his/her own merits, avoid disseminating information capable of bringing a companion into discredit, and not compete unfairly with other geoscientists. He/She should also not induce others to act improperly and unfairly against his/her fellows.

3. The Geoscientist should be objective in criticizing the work of his/her fellows, always acting with due discretion, also accepting the honest and objective critiques of his/her colleagues to his/her work.

4. In the event of litigation against another colleague he/she should, before entering into legal action, seek the good offices of the AGMM in mediating the same.

5. The Geoscientist shall not use a third party for the purpose of concealing the limits imposed by law, to obtain personal benefit. Similarly, he/she should not allow his/her name to be used for the same purpose.

6. In expert reports/surveys/audits, the Geoscientist will keep the most absolute respect for the colleague of the opposite party or author of the professional work under analysis, avoiding any kind of subjective disqualification and confining to technical aspects of the matter. He/She should restrict him/herself merely to issue technical opinions.

7. The Geoscientist in his professional activity recognizes and respects the rights of intellectual and industrial property. He/She is entitled to be recognized for the authorship of his works, being no one

authorized to claim its authorship.

8. The principles referred to in these paragraphs apply to relations with all other professions.

Article 8. Relationships with the Clients

1. The relationship of the Geoscientist with the client is based on mutual trust, which can be facilitated by signing a contract which clearly includes, the terms of reference (s) of the work (s) to be carried out.

2. The Geoscientist is obliged to act in favor of his client, respecting the principle of social responsibility, applying independently and according to his knowledge, the best methods and techniques to ensure the client's objectives.

The principle of independence allows him to refuse the instructions of the client, or of other persons or professionals with whom he/she collaborate or from whom he/she depends on that go against his own professional criteria or against the law in force.

3. The Geoscientist shall maintain the confidentiality of information obtained in the execution of his work and will not disclose, without consent of the client, the documents obtained in the course of his professional activity. Except where court order applies, he/she cannot use his client's information in his detriment.

4. The Geoscientist has the liberty to accept or reject any work that will be requested to him without the need to justify, except by judicial solicitation or official appointment as an expert.

He may abstain or cease his functions with the client, in case discrepancies arise. He/She should not accept assignments that compromise the achievement of others already previously undertaken.

5. The Geoscientist shall inform his potential client about the real limits of his capacity to act, the results He/She can get, the schedule and the approximate costs or basis of calculation as well as the evolution of the work commissioned.

6. The Geoscientist depending on entities providing public service shall refrain from the illegal use of resources and prerogatives inherent to his position, both to his own advantage and for the benefit of others. Still, He/She will abstain of using his position in detriment

or benefit of third parties.

7. The Geoscientist has an obligation to successfully complete all the professional works commissioned except for due cause or due to force majeure.

8. The Geoscientist cannot accept professional work involving actions against a former client where there is some risk that the confidentiality of information obtained in working with the former client may be infringed or bringing benefits to the new client.

9. The Geoscientist should avoid any form of negligence in the exercise of his profession, especially if from such conduct brings risks and material and moral damages for his client, society and environment.

Article 9. Incompatibilities and Conflicts of Interest

1. The Geoscientist should not accept works where there is the possibility of conflict or collision of interests and, in any case, He/She will take the necessary measures to avoid such a conflict in case it occurs a posteriori and renouncing to the work if necessary.

2. In any case, the Geoscientist shall refrain from accepting professional works in which:

a) objective or subjective conditions that endanger his independence of judgment and well-doing occur;

b) a jeopardy of prestige or dignity of the profession occurs or may occur;

c) there is a possibility of collision of interests that may put the Geoscientist in equivocal situation which occurs when, during the same professional activity, He/She performs professional activities simultaneously with activities of other profession or academic title;

d) there is a situation of unfair competition with other colleagues;

e) there is a conflict of interest between his professional activities and his participation in Juries, Commissions, Tribunals and Expertise.

Article 10. Final Disposition

This Deontological and Ethical Code shall enter into force one month after its approval by the AGMM General Assembly, and it shall be immediately given to knowledge of the entire community

of geoscientists via electronic means and published in the national newspaper with the largest circulation.

Glossary

Professional activity – The whole of practices of a profession, of the execution of a technique, or of the exercise of a profession*.

Geocientist – Refers to all professions covered by the Art. 5 AGMM statutes.

Deontological (or Conduct) **Code** – A set of rules to guide and discipline the conduct of a particular group of people according to its principles. It is generally used by companies, organizations, professional classes, or social groups**.

Ethical Code – A document that seeks to expose the principles and mission of a particular profession or business. Its content should be designed to meet the needs that this category serves and represents***. It is done to emphasize the values that should be practiced by professionals and institutions.

Geoethics – Interdisciplinary field between Geosciences and Ethics that covers the Earth and Planetary Sciences and applied ethics. It deals with the relationship between action and thought with the meaning Earth System as a model. It also includes geoeducation, scientific, technological, methodological and socio-cultural aspects****.

* CIME, 2001. Terminologia de Formação Profissional: Alguns Conceitos de Base – III. Comissão Interministerial para o Emprego, Lisboa, Abril (Terminology of vocational training: Some Basic Concepts - III. Interministerial Commission for Employment, Lisbon, April)

** http://pt.wikipedia.org/wiki/C%C3%B3digo_de_conduta

*** http://codigo-de-etica.info/mos/view/Fun%C3%A7%C3%A3o_do_c%C3%B3digo_de_%C3%A9tica/

**** http://www.icog.es/iageth/index.php/home/

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