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PROFESSIONAL AND THEORETICAL GEOLOGY: (GEO)ETHICAL PROBLEMS

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ABSTRACT

Professional geology is based upon scientific and/or applied studies implementing objective field observations, measurements and sampling combined with laboratory studies with all required modern tools and techniques. Results obtained are interpreted within the limitations imposed by lack of sufficient data (e.g., lack of good outcrops; impossibility to reach deeper Earth levels; imperfectness of the fossil record; overprint of thermal events effacing older isotopic evidence, etc.), and by flaws of the scientific theory. The theoretical geology derives basic geologic theories from the wealth of centennial professional observations. Both professional and theoretical geology require an objective description of the facts observed. All requirements in respect of the ethical attitude towards Nature, society, the customer, colleagues and predecessors should be respected, too. On the way of establishment of ethical relations between Nature and Society, a new science, - geoethics, - is being developed. It is aiming at a sustainable development of society in harmony with the natural environment.

INTRODUCTION

Professional geology is based upon scientific and/or applied research applying objective field observations, measurements and sampling, and complemented with laboratory studies performed with modern tools and technologies. Results obtained are interpreted within the limitations imposed by objective difficulties and imperfectness (e.g., lack of sufficient and good outcrops; impossibility for direct observation of deeper parts of the Earth's crust and mantle; imperfectness and gaps in the fossil record; superposition of thermal events that efface older isotopic evidence, etc.) as well as by flaws of the scientific theory. Fast developments of micro-palaeontology, of precise and fast analytical techniques and modern computer technologies led to intensive development of both professional and theoretical geology. Geologists are now armed with such tools that allow for a far more confident determination of deep structures and processes, inclusive at greater depths in crust and mantle, in continental and oceanic environments.

Theoretical geology derives basic geologic theories and hypotheses from the wealth of precise professional research as well as from the fundamental sciences as physics and chemistry. Experimental studies (experimental mineralogy, experimental petrology, experimental tectonics and tectonophysics) are of utmost importance. They allow for modeling of processes taking place in environments that cannot be reached for direct observation. Availability of leading hypotheses and models has always played a stimulating role for the development of professional geology. On the other hand, conscious or unconscious desire to explain all facts observed within the rules of the dominant paradigm often leads to scientific fraud with all possible harmful consequences for science and practice (Hsu, 1997; Zagorchev, 2001). The best traditions of professional geology with their thorough field and laboratory studies are often being replaced by a superficial overview of local and regional geology with modeling of structure and evolution based on the templates of modern geodynamic hypotheses. Such practices are not consistent with the requirements for good scientific practice established by the American and European scientific bodies, and recommended by the European Science Foundation (ESF, 2000).

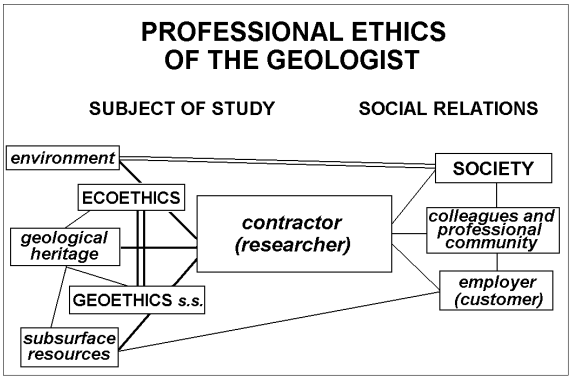

Figure 1. Professional ethics relations

PROFESSIONAL ETHICS

Ethics of the geological studies is based upon the attitude of the researcher towards the research object, the customer, colleagues and society (Загорчев, 2001a). In the geologic and mining practice, these are the interrelations with: 1/ the environment; 2/ subsurface resources; 3/ geological heritage; 4/ the customer /възложителя/ of the studies; 5/ society; 6/ colleagues of the professional community.

Ethical attitude towards the environment, subsurface resources and geological heritage means that both the geologic research and prospection, and the activities issued from their results (mining, etc.) should conform to the maximum to the requirements for protection of the environment and economic exploitation of the resources in view of the sustainable development of the nation and mankind. These problems are the subject of new scientific branches as "ecoethics" and "geoethics". They are obviously interwoven and interdependent both in respect of basic principles, and of the problems they are sought to solve with similar or even, identical methods.

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The relations between the researcher (contractor) and the employer (customer) within each geologic study are based both on the law (the conditions of the bid, the contract) and on ethics. The ethical norms are contained in the ethical codes that exist in all big professional organizations and institutions of geologists, geophysicists and mining engineers. Between the basic obligations and duties of the researcher (contractor) we can mention (e.g., Загорчев, 2001a): frank presentation of own possibilities at the concourse (bidding phase) for a given study; a full information about all previous research on the object of study; informing the customer about all geologic (field and laboratory) activities necessary for performing a high-quality study, and about their price(s) as well as about the best professionals in the given areas; performance of the studies at the best professional level; preservation of the business secrets pertaining to the study results their publication being possible only under the clauses of the contract or with the explicit consent of the client; full information to the client about all possibilities deriving from the study results, about eventual following expenses needed, consequences for the environment, license regimes existing, etc.

The ethical interrelations with the colleagues of the professional community imply (Загорчев, 2001a): participation in concourses, bids etc. for performance of a professional study at an equal base and without use of illegal and/or immoral means; preservation of professional and/or personal secrets of colleagues or the employer (client); abstaining from every form of illegal use of results obtained by others for personal material or moral gains; objective attitude towards all previous results that are of importance for solving the current research problem that are obtained by other (including deceased) colleagues; avoiding misuse of administrative position for to obtain illegally any gains; objective evaluation when reviewing results of others, with taking into account all positive and negative sides (Загорчев, 2001b), and giving an objective final evaluation based on the appropriate criteria for the given kind of report (publication, etc.). The importance of each of the elements listed is self-evident. It should be noted also that the objective evaluation of the results obtained by other colleagues is also an element of ethical attitude towards the whole society as far as each unjustly high or low evaluation may result not only in material harm but also contribute to the demoralization of society in introducing the conviction that success is reached with personal relations, protection and bribes rather than with talent and labor.

PROFESSIONAL ETHICS, GEOETHICS AND ECOETHICS

The term "geoethics" has been formulated in different meanings in the literature published. Some researchers identify it with "geographic ethics" thus implying a subject as wide as geography itself: including in it also ecoethics, animal ethics, ethics of the development, professional and science ethics applied to geography, etc. An even wider definition should include all scientific and applied activities relative to the Earth sciences. In such a wide sense the term "geoethics" is used by many participants in international symposia.

Geoethics is formulated (Nemec, Nemcova, 2001) in a much narrower sense as a science that studies the moral aspects of the relations between man and the mineral resources, and develops the moral standards for activities in the domains of geology, mining, and energy resources. The theoretical aspects include definitions of geoethics, philosophical aspects, interrelations with other Earth sciences and with applied ethics. Practical aspects include the elaboration of geoethical codes, mechanisms for introducing a geoethical behavior, corresponding attitude in decision-making, some specific social and pedagogical problems, etc. According to this author (Загорчев, 2001a), geoethics in such a narrow sense is also a part (*Figure 1*) of the professional ethics of the geologist (geoscientist) because embracing important problems of interrelations between the geologist and mankind with the solid Earth and all its resources, as well as with the geological heritage.

Ecoethics considers the role of mankind in the natural ecosphere, with emphasis on our dependence on the environment, the increasing role of mankind for the deterioration of its parameters, and the consequences for our and future generations and even, for the whole Life on the Earth.

Ecoethics deals with all aspects of atmosphere and hydrosphere pollution with nocive gases, insecticides, pesticides, artificial fertilizers; the climate changes due to the "greenhouse effect"; the destruction of the ozone layer; destruction of genofunds and of biological diversity; soil deterioration and destruction, etc. Ecoethics is directly linked to such social problems as the contrast between rich and poor; the fight for a healthy environment and normal life conditions for the underdeveloped countries and for the society layers in unequal position; problems of war and peace; and most of all, the problems of the sustainable development of mankind with preservation and (within the possible), amelioration of the global resources.

ETHICAL CONFLICTS

One of the basic ethical problems is the conflict of interest. The variety of relations between the Earth and mankind as well as between people and their social groups creates many conflict situations many of them not solvable with laws and ethic codes. Here come the problems of personal ethics and moral integrity, and for the priority of one moral norm to the other(s).

In the sphere of professional relations such conflicts arise in cases of scientific and professional misconduct. Which moral norm has the priority? – dedication to science and truth or collegial relations, friendship or group or individual interest? Is whistleblowing and disclosure of misconduct (as falsification and fabrication of data; omission or theft of data and ideas of others; giving of degrees and titles for minor or non-existing

merits) conforming to ethic norms or collegial and friendly relations are obliging us to close the eyes and to remain indifferent to such phenomena? Should we follow our personal interests and keep our tranquility in neglecting the interest of society?

These problems are not less acute when considering the relations of the geologist with his client. In the ideal case, there is a self-identification of the researcher with his client, i.e., the geologist makes everything possible to obtain the maximum of result performing all methodically necessary field and laboratory studies for to solve the problems. Then, the researcher meets limitations imposed by the financial and logistic means at hand, and by the deadlines. His personal training and talents are also crucial. The necessity to compromise is evident, the problem is where to set the boundary of the necessary compromise, and from which point onwards the employer or client should be frankly informed about the necessity of additional analyses, expenses, experts, etc.

The most serious conflicts have a strictly geoethical character. Prospection and exploitation of minerals seriously harms Nature. The soil layer is being destroyed; the ecosystem is damaged and polluted. The interest both of the geologist and of the client is directed to the discovery and maximum extraction, hence profit, of the precious mineral(s), involving minimum of expense. The needs to preserve the environment and the Earth's resources requires every prospection to be made in such a manner that to bring minimum of harm and damage (pollution, landscape deterioration, destruction of natural monuments and sites of interest, etc.) and to preserve for future prospection and exploitation the reserves judged to be not of interest for the moment. Both the prospection and the following mining activities should enable a subsequent rehabilitation of the terrains as well as the preservation (in museums or *in situ*) of important specimens, and even, of whole sectors of a given deposit (irrespectively whether it is a ore deposit, of decorative stone of non-metal deposits, or a site containing interesting minerals or fossils) that represent an element of the geological heritage.

The ethical attitude towards the environment is also an element of ethical behavior in respect to Society. The sustainable development means to create and firmly establish such social consciousness that puts the interests of Society and the future of mankind above any egotistical personal, corporative or national interests, for a maximum preservation of the natural resources of the planet Earth – our unique common home.

ETHICS AND EDUCATION

The question whether scientific and professional ethics should be taught in the universities is subject of a broad discussion in discussion groups and science ethics networks. Both supporters and opponents of the idea have serious arguments. The following conclusions can be drawn from the discussions published.

1. Disturbing cases of violation of the ethical principles have been recorded. The most drastic cases are related to scientific fraud and falsifications that are threatening the health of thousands of people. Besides that, scientific and/or professional misconduct in wider although not so sensitive spheres is undermining the authority of science, scientists and professionals in society.
2. It is of primeval necessity to create, accept and introduce national codes of science and professional ethics. Parallel to this, mechanisms should be established for to control the application of the rules accepted by all members of the professional community.
3. With the introduction of national ethical codes, systematic efforts should be made for to indoctrinate the whole scientific and professional community with the norms of ethical conduct and good scientific practice.
4. A basic role in education is played by the good examples of correct scientific and professional conduct by known scientists and lecturers. The good style of lecturing in all domains should include a high professionalism; ethical behavior to nature, the research object, the employer/client, the geological heritage and the colleagues and their contributions to science and practice. The young colleagues should receive attention and regard as well as a just evaluation of their achievements. In the same time, all kinds of misconduct by graduate and Ph. D. students should find a fast and just sanction.
5. "Training must also inculcate the core ethical standards and norms of science, as well as principles of best scientific practice" (ESF, 2000). The university curricula should include also studying the basics of science and professional ethics and the corresponding ethical codes.

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