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Ukraine's prospects in development of marine mineral deposits

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Abstract. It is shown that the known reserves of marine minerals, including polymetallic nodules hydrates, marine sapropels, etc., will last the humanity for thousands of years. International cooperation and broad cooperation of companies and enterprises of maritime mining are needed to conduct the search, along with research and operation of deep mining complexes. This will allow us to prepare for the commercial development of marine deposits of mineral and energy resources in the near future.

Key words: offshore fields, minerals, gas hydrates, marine sapropel, biofuels, mining complexes

INTRODUCTION

Until recently it was believed that, in the foreseeable future, the international community would face a total shortage of energy and mineral resources, given that reserves in the mainland are limited. Therefore, for more than half a century, attention has been directed to an intensive study of the resources concentrated in the sea [1].

According to experts, approximately 500 billion dollars are spent on oceans research annually. At present, the ocean waters house more than 40 drilling ships and 200 drilling rigs with drilling to a maximum depth of 12 km.

Marine Geology has ceased to be a purely romantic science. A new stage in its development is due, above all, to the discovery of large oil and gas fields on the continental slope, which, compared with the shelf remain virtually unstudied. At the end of the last century, we began preparing for the industrial development of deep-water fields with metalliferous material: polymetallic nodules, containing Mn, Ni, Cu, Co, Mo, Zn, and energy resources - gas hydrates (methane in the solid state).

According to preliminary estimates, the total reserves of gas hydrates in the oceans make up $12...76\times10^{19}$ m^3, polymetallic nodules - 300 billion tons (only in the Pacific Ocean - 165 billion tons). Ferromanganese metal ore: Mn - 30%; Ni - 1,3%; Cu - 1.2%: from - 0.2% to nearly 30 useful components, stocks of which are constantly increasing [2].

Thus, the annual accumulation of manganese nodules is approximately 3 times greater than the consumption of the world's industry in the same period of time, the accumulation of cobalt and zirconium is even greater (respectively 4.5 and 5 times). This means that the stocks of mineral resources in the oceans can still last for hundreds and thousands of years.

DEVELOPMENT OF UNDERWATER FIELDS

In the 1990-s. the Soviet Union and the United States carried out experiments to test the dredge (disturber) for modeling the process of nodule mining and identifying the negative impact on the environment. Japan tested unit collection PN at depth of 2200 m in the center of the north-western Pacific Ocean. China, India, South Korea and other countries - sites owners [3] have also actively conducted research .

The expected timing of commencement of commercial production is as follows: gas hydrates - the second, and PN - the third decade of the XXI century. The country that will be better prepared in the scientific and technical point of view by this time, i.e. will find a reliable way to access to raw materials from subsea fields, will win the competition.

Since 2006, Canada, Norway, the U.S. and Japan have begun piloting commercial development of fundamentally new and fabulously wealthy (166×10^{17} m3 of methane) hydrocarbon energy source - metanogidrata, which in the form of "combustible ice" (112×10^{17} m3 CH_4) and "methane ice" (54×10^{17} m^3 CH_4) lie in the depths of permafrost regions of mainland-island land in sediments by 93...95% of the world's oceans.

With total world oil and gas reaching 2804×10^9 m3 (4 billion m3 of oil and 2800 billion m3 of natural gas), they can suffice for mankind for nearly 6 million years. Even if the predictions come true by 10%, still the objective - to provide reliable access to the deposits of gas hydrates and the development of industrial technology of their production - justifies the means.

BLACK SEA REGION RESOURCES

In recent years, the Black Sea region became a zone of special attention as a potential source of marine minerals, and not only for the Black Sea countries. [4].

In the Black Sea region geological reserves have been found of gas hydrates (solid gas) 25...30 trillion m^3; sapropelic muds (agrochemical raw materials) - $3.2...10^{11}$ m^3; fine sands - up to 100 billion tons, fresh water (common stock) - 178 million m^3 per year; gold placers - 100 ... 150 tons, limestone - unlimited, spa mud - 70 million m^3; sulfur - a few billion tons, there are also reserves of iron ore on the shelf south of the Kerch Peninsula with iron content 35...39%, etc. [5].

In addition, with the construction of oil and gas pipelines, the bottom of the Black Sea is increasingly becoming a building site. Therefore, issues of security, including the environmental safety, involving the works and exploitation, are in the foreground. [6]

SEABED PROGRAM DEVELOPMENT

The development of ocean resources related to government priorities of Ukraine is considered as a necessary condition for the development of scientific, technological and industrial potential of the country.

In 1993, Ukraine adopted a "national program of research and resources of the Azov-Black Sea shelf and other regions of the World Ocean for the period until 2000" [7]. It was attended by over 60 companies and organizations of various Ministries and Departments of the NAS of Ukraine, Ministry of Education of Ukraine. Work across the country has been coordinated by the "National Agency for Marine Research and Technology" (NAMIT), reporting directly to the Cabinet of Ministers of Ukraine. The leadin builder of hardware for the marine sub-sector of mining was identified as NIPIOKENMASH Institute (now former) in Dnepropetrovsk.

During this period, a considerable amount of work was done on the study of mineral resources of the seabed and the creation of means for their development. Unfortunately, up to now they have not been claimed in full and, of course, out of date. In our country, many areas of technical developments on the project pilot sample mining installations for mining PMK in the oceans.

Due to the economic crisis in the second half of the 90's., the problem of development of marine resources has fallen out of the priorities. There are no own boats (OB), equipped with special modern research complexes in Ukraine. Termination of funding and the lack of real support from the government has led to the loss of the leading position, the breaking of scientific and industrial relations, destroying experimental base, design documentation, and as a consequence, to a lag of domestic equipment and technologies from the world's average.

INTERNATIONAL COOPERATION

Starting in 1995, Ukraine has to negotiate with the international organization Interoceanmetal (IOM) to accede to the Agreement on the establishment of a joint organization for work on prospecting, exploration and preparation for the commercial development of ferromanganese nodules. The first members of the consortium, formed in 1987, were members of the CMEA countries: Bulgaria, China, Cuba, Poland, the USSR and Czechoslovakia. Subsequently, negotiations were suspended and frozen in 2004 by the Ukrainian side.

Status "pending expectations" industrial development subsea led to an apparent lag of Ukraine advanced countries. And this - the loss of markets of high technology products and dependence on foreign suppliers of strategically important raw materials scarce.

In 2006 the "National program of mineral resources of Ukraine till 2010" was adopted [8], which is part of the preparation for the development of future seabed defined objectives:

– Search in the Black and Azov seas for hydrocarbons, sapropel, building materials and learning gold mineralization;
– Search and exploration in the oceans for polymetallic nodules, testing equipment and technologies for extraction and processing.

Unfortunately, after many years of inactivity, in 2006 the American company "Vanco International Ltd." won an open competition and the government entered into an agreement to explore and develop oil and gas field Kerch area of 13 km^2 of Ukrainian shelf at depths of 300 to 2000 m.

On leased land, the latest drill ship will be exploited, whose one-day work costs over 1.2 million $ USA. The total investment of the company in 30 years is to exceed $ 15 billion. Although the first right to purchase shares "wreath" in the production of hydrocarbons, according to the contract, belongs to the Ukrainian side - they will have to buy likely at world prices, and domestic researchers are unlikely to get access to the leased land.

Preparing for the subsea development requires significant investment and long-term planning.

PROSPECTS FOR THE DEVELOPMENT OF MARINE RESOURCES

And yet, despite the negative trend of recent years, Ukraine has the necessary prerequisites for the restoration of its scientific, technical and technological capacity.

According to the results of previous cruises, the "Professor Vodyanitsky", "Kiev" and others performed extensive research on the geology and marine sapropel for agricultural, industrial and environmental purposes. It has been found that the use of mineral mixtures based on sapropel reduces weight dose of fertilizers by 17 times.

Biofuels fever that gripped the world, requires increased acreage and increased efficiency. Increase in the production of biofuels can solve a number of economic (higher energy prices), political (independence from the supplier countries) and environmental (not polluting the atmosphere) problems.

Proved, the Black Sea sapropel muds increase the efficiency of crop and it is obvious that they will be in demand. And agriculture can become very profitable for Ukraine, which will increase its role in the international arena, as the breadbasket of Europe.

Sapropel application also showed good tread properties on infected radionuclides. They have a term used in construction, medicine and other fields.

Industrial development of deposits of sand in deep terraces shelf can solve the problem of the expected shortage of this raw material in Europe. This is especially true in view of the ring road around the Black Sea, the length of 7500 km.

The study of volcanic gas is of particular interest. It is assumed that the extent of this type of gas release in the Black Sea is estimated as at least hundreds of billion m^3.

COMPETITIVENESS AND THE POTENTIAL OF COUNTRIES

In conditions of market relations it is extremely important to keep up with world-class R & D, which threatens the loss of competitiveness of domestic producers. Gradually, there comes to understanding the need of the national policy on mineral resources of the Azov-Black Sea basin and the oceans. Its performance, in the foreseeable future, could lead to a change in the geopolitical situation in the region and in the world.

The examples are not far to seek: today it is oil and gas, tomorrow - hydrates and strategically important raw materials for the steel industry, without which you cannot get a quality metal, then - the development of agrochemical raw materials which will enable the solution of the more and more acute in recent years problem of food shortage.

In 2008, the National Security and Defense Council of Ukraine adopted a decision "On Measures for the Development of Ukraine as a Maritime State" [9]. With its appearance talks with "Interoceanmetal" were resumed not only on the level of technical expertise, but also on the State level. It is hoped that with the development of the Maritime Doctrine of Ukraine adopted in 2011 and the new "National Program of Mineral Resources of Ukraine till 2030" [10], our situation will change.

Subsea technology is not less complex and global than space one. Constantly evolving, it requires a tremendous knowledge of all areas of fundamental and applied science. Therefore, developed countries are investing heavily in training for commercial development of metalliferous and energy resources, exploration of new fields, and corresponding training.

In this area, as in any other activity, there is a tremendous need for scientific and technical support of products, development of new ideas, development and implementation of innovative projects, copyright protection in the sale of intellectual property rights (licenses). New technologies have become so sophisticated, costs for their approbation even at the level of pilot samples, especially for deep-water conditions, so important, competition in the market of high-tech products so tight, that it is difficult to rely on individual success [11]. Thus, the cooperation and collaboration of enterprises and firms within the project can be the basis of real success.

In our country, fairly strong scientific potential has remained - in the institutes of the NAS of Ukraine, in universities, in industrial research institutes, enterprises and organizations. Success in this case is: advanced domestic science schools, meeting modern requirements research base, to form a sufficiently strong field of mechanical engineering, with significant reserves. All this allows us to be in demand in the emerging market for marine technologies of mining and metallurgical structure.

Today, investing in research and production, usually returns are expected almost immediately. However, projects on the problem in this category must take time to achieve their profitability. Exploration and development of mineral deposits on land sometimes takes much longer, but the results can by far outweigh the costs (oil, offshore gas, nickel, diamonds, land and so on). Such issues cannot be ignored, because in the area of sea mining at the level of industrial designs, virtually all is to be created for the first time.

CONCLUSIONS

The development of complex projects in joint international programs, support of innovative projects are the most effective and realistic ways for Ukraine to join the leading countries, which are involved in the preparation for commercial development of offshore mineral and energy resources.

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