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Prospects for Integrated Development of Iron Ore Deposits of the West Siberian Belt

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Abstract

The prospect of the integrated development of the world's largest deposits of sedimentary oolitic iron ores of the West Siberian belt is examined. It is shown that the use of modern geotechnological methods: underground leaching of oolitic ores with the integrated use of peat in chemical and metallurgical processes will allow to quickly develop the rich potential of the Bakcharskiy ore cluster.

Keywords: West Siberian iron ore belt; Bakcharskiy ore cluster; Integrated development; Oolitic ores; Underground leaching; Peat

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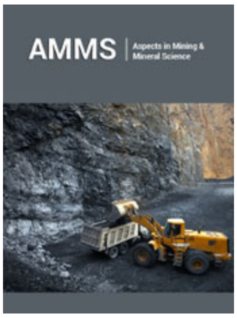

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The world reserves live of iron ores by the beginning of the XXI century has averaged 150-200 years, but for some countries it has barely reached 5-10 years [1]. Therefore, today it is necessary to contemplate about a new raw material base for ferrous metallurgy, about the transition to new modern and cheaper technological schemes of extraction and redistribution of iron ores [2]. Such a reserve is the largest West Siberian iron ore belt, which has been able to meet the needs for iron, phosphorus, and vanadium for centuries [1]. The West Siberian iron-ore belt of coastal-marine chemogenic oolitic goethite-hydro goethite-leptochlorite ores is a strip about 150km wide and about 6000km long from the basin of the Turukhan and Bolshaya Kheta rivers in the northeast to the headwaters of the river Om in the southwest, flanking the West Siberian Lowland from the east and south with a total area of up to 300,000km^2. Lisakovskoye and Ayatskoye deposits (Republic of Kazakhstan) are located on the western edge of the belt, Kolpashevsky and Bakcharsky ore clusters (the largest objects) are located on the eastern edge, within the limits of Tomsk region. Their reserves are not even taken into account by the balance of the country due to low iron content in the ores (30-40%) and their poor washability, as well as due to very difficult mining conditions of operation, both using mine and open-pit methods due to a significant water cut of the overlying rocks and ore bodies [1,3].

The use of this richest potential of iron ores is possible by means of a modern geotechnological method-the underground leaching method [3], which has found wide application in the exploitation of epigenetic deposits of uranium [4], gold and other minerals occurring in porous water-flooded rocks. The idea of underground leaching of minerals is increasingly attracting the attention of the mining industry, in particular, for extraction of uranium, gold and some other elements, but it seemed unacceptable in the development of iron ores that require huge volumes of productive solutions (mineral acids), special methods for separating iron from solutions, and the solution of a number of technological issues [3]. We are considering the possibility of the integrated use of the territory [5,6], which is based on a favorable combination of natural resources (ore, peat, chloride brines) and allowing solving problems that seem not to be solved (the development of swamps in Western Siberia, extraction of iron, phosphorus, vanadium, aluminum, production of electricity). The spatial coincidence of two unique basins, namely iron ore and peat, contributes to the development of a single process chain, which allows developing on a large scale two types of deposits previously referred to as off-balance, the development of which was considered unprofitable from modern economic positions [3]. The cost of the resulting products with the appropriate technological analysis of the processes will be significantly cheaper than using mine or open-pit mining methods [3]. The use of the given method allows consistently increasing the extraction of iron up to thousands and millions of tons with a gradual increase in capital investments, with a simultaneous increase in extraction and processing of peat [5]. This method allows, as experience is accumulated, to involve all new landfills at the lowest cost.

Results

The proposed process flow diagram allows achieving the following results:

a. to extract iron, vanadium, phosphorus, rare earths and, possibly, aluminum;

b. iron can be produced outside the blast-furnace method of reduction in the form of a new technological product – iron powder, necessary for the widespread implementation of progressive methods of powder metallurgy. Part of the iron powder can be subjected to electrometallurgical processing to produce high quality vanadium steels and ferrovanadium. Iron powder can be exported on its own. If necessary, it is possible to produce a mixture of peat semi-coke with iron oxides for blast furnace smelting;

c. to produce large quantities of combustible gases that will satisfy not only the internal needs of the mining industry, but can also be used for gas supply or electricity supply to nearby cities;

d. it is possible to produce a wide range of chemical products obtained as by-product components during thermal processing of peat and peat-ore concentrates, mainly due to peat resins;

e. development of deposits according to the proposed scheme, in contrast to other types of mining operations, results in transformation of swampy and unsuitable for life landscapes into cultural ones with farmland, forests, lakes, etc.

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