Fachzeitschrift für Metallurgie

METALL

Technik · Wissenschaft · Wirtschaft

Special: Edelstahl, Spezialstahl

EuroBLECH 2014

Industrie 4.0

Brücken aus Edelstahl

Kleine Metallpulvermengen

Energieeffiziente Anlagen

www.GDMB.de

Einzel-Verkaufspreis: 21,50 €

GDMB Verlag GmbH
Paul-Ernst-Straße 10
D-38678 Clausthal-Zellerfeld
PVST · Dt. Post AG · Entgelt bezahlt

GDMB Verlag GmbH

68. Jahrgang · Oktober 2014
GDMB Verlag GmbH
ISSN 0026-0746

10

Mineral wealth of the Caspian Region states and their prospective cooperation with the European Union

Laubertová, M.; Šándorová, K. (1)

Mineral reserves of the European Union have been gradually reduced for decades. The growth of innovative technologies and products that require new materials is dependent on raw materials, which the European Union does not dispose of at all, or only in a minimal amount. The goal of the new EU mineral policy is to ensure a better access to raw materials, which should improve the competitiveness of the European continent in the global economic competition. One solution to this situation is to establish cooperation with the countries that have a relative abundance of mineral raw materials, and to ensure non-discriminatory access to raw materials. The aim of this work is to analyze the current state of minerals in the Caspian region states, to overview energy, ore and non-metallic materials and design possibilities for the European Union to succeed in individual countries of the region.

Raw materials are an essential condition for the sustainable functioning of modern societies. The specific characteristics of raw materials are their non-renewability and non-relocatability. In general, raw materials are considered the material input for the production, while the usable parts of the earth's crust except water are considered raw materials. Primary raw materials are natural substances of organic and inorganic origin. Secondary raw materials are raw materials derived from waste, which are suitable for further economic or other use [1].

The basic division of mineral resources is as follows: Mineral fuels (oil, gas, coal, uranium), Metals - any mineral resources from which metals can be produced by compaction (such as Fe, Au, Cu, Pb ores, etc.), Industrial minerals that are used for purposes other than the production of metals (barium, dolomite, magnetite), and Construction materials (crushed stone, gravel sands and brick clays). According to the suitability of stocks for economic exploitation, economic reserves of a state are assessed as currently usable, which meet our present technical, technological and economic conditions of exclusive use of a reserved deposit or part thereof. Reserved mineral deposits are the mineral wealth of the state and are in its possession [2].

Access to and availability of raw materials is essential for the proper functioning of the economy of the European Union. Sectors such as construction, chemicals, automotive, aerospace, machinery and equipment industries providing employment for about 30 million people, all depend on access to raw materials. Since the EU has a shortage of raw materials, the European industry depends on raw materials imported from abroad.

Potential of mineral wealth of the European Union

Mineral fuels of the European Union

The European Union is the world's largest importer and the second largest consumer of energy. At present, issues related to energy security in Europe are of the foremost concern. There are several important reasons for this, such as the lack of energy reserves and the increasing dependence on one supplier - Russia. One of the most important priorities of the EU Members States is the search for alternative ways of ensuring the energy security for Europe. For several years, the continuing Russian-Ukrainian dispute about natural gas supply has been complicating its transit to Europe. Recently, one of the most important and widely discussed energy projects proposed by the EU is the Nabucco project. A key supplier within this project is the area of the Caspian Sea. In the near future, the situation in Central Asia will depend, among other things, on the reserves of energy resources in the Caspian Sea. Currently, it is considered the third largest oil deposit in the world after the Persian Gulf and the Russian Federation. It is expected that by 2025, the importance of this region as well as its impact on international politics will have increased significantly [3]. The European Union is currently in a situation where we can say that it is just looking for its foothold in Central Asia, a region where it must face an exponential growth in China, as well as persistent and traditionally strong influence of the Russian Federation. In order to develop mutual economic relations, the European Council adopted the Strategy for a New Partnership in 2007, which set certain basic goals in the region, such as support to accession of the countries to the World Trade Organization, greater availability of products from Central Asia, export promotion, economic diversification and economic and commercial structures, especially in terms of developing partnerships in state and private sectors (European Union, 2007) [4]. Currently, the EU's relationship to the Caspian region is based just on large companies, mainly trading in the energy sector. Small and medium-sized businesses do not have a strong position on the market, and this is a discouraging element for investments. Also, when compared with other regions of the world, the Central Asian region is not the most profitable - wages are relatively high, technological skills are on the decline, the investment climate is not the best, and the political situation in most states is unstable. However, it appears there is also another dimension of the European presence in the region, namely a certain effort for the "Europeanisation" of the region. Activities of European companies in the region may seemingly be based on trade and profit, but, in fact, they can also promote a model of the European way of life and the European market economy that respects social rights. In the long term, it could be an extension of this model to the population of the Caspian region. However, it is difficult to imagine cooperation, for example with Germany and France in the manufacture of automobiles and compo-

	Raw materials	Main producers (2008, 2009)	Main sources of imports into EU (2007, or 2006)	Import dependency rate	Substitutability	Recycling rate
1	Antimony	China 91% Bolivia 2% Russia 2% South Africa 2%	Bolivia 77% China 15% Peru 6%	100%	0,64	11%
2	Beryllium	USA 85% China 14% Mozambique 1%	USA, Canada, China, Brazil (*)	100%		
3	Cobalt	DRC 41% Canada 11% Zambia 9%	DRC 71% Russia 19% Tanzania 5%	100%	0,9	16%
4	Fluorspar	China 59% Mexico 18% Mongolia 6%	China 27% South Africa 25% Mexico 24%	69%	0,9	0%
5	Gallium	NA	USA, Russia (*)	(*)	0,74	0%
6	Germanium	China 72% Russia 4% USA 3%	China 27% USA 19% Hong Kong 7%	100%	0,8	0%
7	Graphite	China 72% India 13% Brazil 7%	China 75% Brazil 8% Madagascar 3%	95%	0,5	0%
8	Indium	China 58% Japan 11% Korea 9% Canada 9%	China 81% Hong Kong 4% USA 4% Singapore 4%	100%	0,9	0,30%
9	Magnesium	China 56% Turkey 12% Russia 7%	China 82% Israel 9% Norway 3%	100%	0,82	14%
10	Niobium	Brazil 92% Canada 7%	Brazil 84% Canada 16%	100%	0,7	11%
11	Platinum group metals	South Africa 79% Russia 11% Zimbabwe 3%	South Africa 60% Russia 32% Norway 4%	100%	0,75	35%
12	Rare earths	China 97% India 2% Brazil 1%	China 90% Russia 9% Kazakhstan 1%	100%	0,87	1%
13	Tantalum	Australia 48% Brazil 16% Rwanda 9% DRC 9%	China 46% Japan 40% Kazakhstan 14%	100%	0,4	4%
14	Tungsten	China 78% Russia 5% Canada 4%	Russia 76% Bolivia 7% Ruanda 13%	73%	0,77	37%

Tab. 1: Production concentration of critical raw materials their recycling and substitutability [8, 9]

nents, or in other sectors such as chemical industry, mechanical engineering, etc. On the other hand, it would be possible to support companies through financial advantages, reduction of taxes, legal advantages in setting up companies, etc., which could encourage cooperation between companies from several Member States to create a strong alliance benefiting from the Central Asian market [5].

Metal and non-metal materials of the European Union

Raw materials are an essential part of modern technology and everyday consumer products. The report of the expert group led by the European Commission of 17 June 2010 shows that their availability is subject to increasing demand. The lack of any of the 14 critical raw materials would then mean serious problems for the European industry. The EU has identified the following critical raw materials:

antimony, beryllium, fluorspar, gallium, germanium, graphite, indium, cobalt, platinum group metals, rare earths, magnesium, niobium, tantalum and tungsten. Mercury has not been included on the list yet [6].

The new raw materials policy of the European Union, whose foundations were formulated by the European Commission in the years 2008 - 2011, is based on three fundamental pillars of better access to mineral resources. This should increase the competitiveness of the European continent in the global economic competition. The first pillar is the establishment of cooperation with countries that have a relative abundance of mineral raw materials and provision of non-discriminatory access to raw materials. The second pillar is the creation of a higher utilization rate of the European mineral resources. The use of material-friendly technologies and the increase of the recycling rate were determined as the third pillar [7, 8].

The critical raw materials for the European Union show a particularly high risk of supply shortage in the next 10 years. There is a risk associated with the concentration of production in several countries, and low political and economic stability of some suppliers. In many cases, this risk is amplified by low substitutability and low raw material recycling. A stable source of raw materials is important also for political objectives and technological innovations. For example, rare earth elements (REE) are essential for high performance permanent magnets in wind turbines or electric vehicles, for catalytic converters in automobiles, in printed circuit boards or in fiber and high temperature superconductors. The EU is completely dependent on imports of rare earth elements, while China's share in the world production of REE was up 97% in 2009. At present, no recycling or replacement processes for rare earth elements are commercially available [8,9]. Table 1 shows the important materials, because insufficient supply risks and their impacts on the economy are higher compared to most other materials. The high risk of raw material supply is mainly due to the fact that a high share of global production comes from only a few countries that have strong political representation in the world: China (antimony, fluorspar, gallium, germanium, graphite, indium, magnesium, rare earths, tungsten), Russia (platinum group metals), Democratic Republic of the Congo (cobalt, tantalum) and Brazil (niobium and tantalum). This concentration of production is, in many cases, reinforced by low substitutability and low recycling rates.

Central Asia is one of the world's regions with a significant geostrategic position. These countries are currently attracting international interest mainly because of the presence of mineral deposits, commercial potential based on their geographical location as well as theoverall global significance [10].

Current status and characteristics of the Caspian region

Geo-political definition of the region

The Caspian Sea is an inland waterway pool with undetermined geographical status, whether it is a sea or a lake. It has an area of 400,000 km² and a depth of 1025 m. Furthermore, even its legal status is not identified. Problems have occurred after the disintegration of the Soviet Union and the formation of four new states bordering the water pool [11].

The newly established states have agreed that the new status of the Caspian Sea can be accepted only in the form of consensus. However, this has not been achieved yet. The term "the Caspian region" includes the Caspian Sea region and the neighboring countries (Kazakhstan, Turkmenistan, Azerbaijan and Iran) and partly Russia [12]. Although its status is not precisely defined, we could say that it is the largest water reservoir abundant in huge mineral wealth [13]. In recent years, the issue of the Caspian Sea has become particularly acute on the international scene in terms of its position of a prospective supplier of oil and gas on the world market.

The political map of the area reflects the complicated territorial division of the state-space (see Fig. 1), resulting from the heterogeneous ethnic and religious structure of the population [14].

In three of the four separate states, there are several autonomous territorial units; in each of them more or less latent conflicts caused by ethnic and religious differences exist, leading to contradictions. Some are temporarily solved by a fragile but long-term ceasefire [10].

The next chapter will characterize individual states of the Caspian region in terms of their area, population, mineral reserves and their economy.

Fig. 1: The political map of the Caspian Region [15]

General characteristics of the Caspian region states

Azerbaijan

Azerbaijan is situated on the border of Europe and Asia, in the middle of the "Transcaucasian transport area". It is the Asian country, formerly the Federal Republic of the Soviet Union. Azerbaijan borders Georgia and Russia to the north, Iran to the south, Armenia to the west and the Nakhichevan enclave borders Turkey. The population and area of the country are shown in Table 2 for a better comparison with other Caspian states. The main wealth of the country consists of mineral reserves, especially oil shown in Table 3 and Fig.2. There are also iron ore and precious metals. In Nakhichevan, it is molybdenum. Mainly petrochemical, metallurgy, chemical industry (production of end products of non-ferrous metals such as aluminum, copper, gold, silver, platinum, titanium and cobalt), production facilities for the extraction and processing of oil, mechanical and electrical engineering are developed. Interesting is the manufacture of cosmetic products, manufacture of polymers and polyurethane products, technologies for recycling solid waste, engineering industry and production of construction materials. Electricity is produced by heating oil and natural gas thermal power plants [16, 17]. Azerbaijan's gas reserves are estimated at 3-5 trillion m³. Also the Nabucco project promoted by the European Union is interested in Azerbaijani gas. Azerbaijan actively trades with 150 countries of the world. It is a member of many international economic organizations. The foreign trade turnover between the Slovak Republic and

Azerbaijan is very low, despite the potential, which is in export and import operations of mainly goods, but also services.

Iran

The Islamic Republic of Iran is a country in Southwest Asia. On the west it borders Iraq, Turkey, Armenia and Azerbaijan to the north-west, Turkmenistan to the north, Afghanistan and Pakistan to the east, on the south-west it is washed by waters of the Arabian Gulf and the Arabian Sea and to the north there is the Caspian Sea [10]. The population and area of the country are shown in Table 2 for a better comparison with other Caspian states. The country has oil reserves in the total amount of about 18 billion tons, ranking the third place on the world stage. With respect to gas, it ranks even second [18]. The Iranian economy is largely subject to the state control; just small businesses are in private hands. The most important economic sector is mining, processing rich deposits of oil and gas in the west of the country. In addition, they have important textile industry, agriculture and the production of cement and building materials. In 2005, Iranian power capacity reached 41,000 MWh of electricity. As a fuel, oil is used primarily. As it is a valuable export commodity, it has been proposed to build about 20 nuclear power plants and installations for the production of nuclear fuel [18]. Iran produces smelter copper, chromium ores and concentrates [19].

Since 2005, the government continues to pursue confrontational politics against mature democracies, and the continuation of a controversial nuclear program brings the country into international isolation and has a great impact on the economy. In 2010, the EU decided to adopt sanctions against Iran (which are directed against the transport, energy and finance sectors, while investing in the oil and gas industry in the country is also prohibited. The EU's ambition is to continue negotiations with Iran over its controversial nuclear program. The Slovak-Iranian economic and trade relations are not burdened with any problems yet are underdeveloped and lag far behind their economic potential [20].

Kazakhstan

Kazakhstan is the most economically developed country of the former Soviet countries in Central Asia. Kazakhstan, long form Republic of Kazakhstan, is a country in Central Asia with a small part also in Europe. It borders Russia on the north-west and north, China on the east, while on the southern side its neighbours are Kyrgyzstan, Uzbekistan and Turkmenistan and in the southwest it borders the Caspian Sea. The population and area of the country are shown in Table 2 for a better comparison with other Caspian states. The Kazakhstan's economy is based on large mineral resources as well as agriculture and livestock production. The country has a well developed mining, materials processing, engineering and armaments industry. Kazakhstan is ranked sixth in the world in terms of reserves of mineral resources. Kazakhstan has about 8% of world reserves of iron ore, 25% of world reserves of uranium, 19% lead, 13% zinc and 10% copper and iron. Kazakhstan ranks first in the world in tungsten and vanadium ore stocks, second in the world in chrome ore deposits, third in manganese ores, fourth in molybdenum stocks and eighth in iron ore reserves. Coal reserves are 35.8 billion tons. It is 3.69% of the global reserves in 2011.

In January-November 2011, compared to the same period in 2010, the volume of industrial production reached 103.8%. The extraction of coal and lignite, natural gas, iron ore and oil increased. The production of chemical and mechanical engineering as well as the production of non-ferrous metal products increased. The five largest customers of Kazakh oil in the EU /through Russia/ include Italy, France, Netherlands, and Austria. China imports 14.2% of total oil volume from Kazakhstan. Oil and gas export is a major source of revenue for the Kazakhstan's state budget ensuring economic growth of the country. The production and export of non-ferrous metals is the second most important export commodity providing earnings to Kazakhstan. The share of metallurgy in the total volume of industrial production of Kazakhstan exceeds 12%. Extracted ores are used to produce copper, lead, zinc, titanium, magnesium and precious metals. Kazakhstan is a major exporter of refined copper (2.3% share of the world's production), all of which is exported. Kazakhstan is ranked third in the gold mining among the CIS countries (170 gold deposits). Over 70% of mined black metal ores is exported [21]. Kazakhstan can be considered a macro-economically stabilized country with the developed industry. Real GDP growth in Kazakhstan in September 2011 reached 7%. According to the statistics, the industrial production growth was 3.6%. Kazakhstan is one of the countries with the largest world reserves of fossil fuels. The European Union is the largest trading partner of Kazakhstan, with oil and gas making up 80% of the country's exports. However, in the future, the oil should not dominate [22].

Turkmenistan

Turkmenistan is a country in Central Asia. It borders Afghanistan to the south-east, Iran to the southwest, Uzbekistan to the northeast, Kazakhstan to the north-west and the Caspian Sea to the west. The population and area of the country are shown in Table 2 for a better comparison with other Caspian states. Turkmenistan is largely a desert country with intensive agricultural production in irrigated oases. Natural resources are natural gas, oil, sulphur, iodine, non-ferrous metals, potassium and rock salt. The fuel-energy sector is the most important part of the economy of the country, which virtually the entire economy depends on.

Of the total volume of industrial production, the fuel-energy complex share is 27.5%, as for chemicals, it is 5.4%, 5.1% engineering, 41% light industry (essentially, primary processing of cotton). The mining industry is dominant, while the processing industries are still underdeveloped [23].

Now, the most important source of revenue is the mining industry. Problems with the sale of oil and especially Russia's monopoly on its purchase still do not allow the economy to grow. In recent years, however, the increased oil exports together with the rise in oil prices have a positive impact on the economic growth. The country has 60% unemployment rate and deep poverty, which is one of the biggest problems of the country, along with the failure to respect human and civil rights of its citizens [24].

Russia

Russia, the official name – the Russian Federation, is the successor state of the Soviet Union. The main raw materials mined in this country are: petroleum, natural gas, brown coal and nickel. Russia has huge oil and titanium reserves. Although, Russia is a part of the Caspian region, it will not be analyzed in more detail in this paper, as it affects this region only marginally.

Country	Populations (million)	Area (thousand km²)	Mineral resources	Industry
Azerbaijan	9,2	86,6	oil, natural gas, Fe-ore, Mn, Fe, Ti, Au, Ag, Cu, Co , limestone, travertine, marble	mining, chemical, engineering, petrochemical
Iran	71,2	1648,2	Oil, Natural gas, Fe-ore, Cr	textiles, construction chemicals, automotive, petrochemical mining, metallurgy (steel production), production of cement and construction materials
Kazakhstan	16,6	2717,3	Oil, natural gas, coal, lignite, bauxite, construction materials, rare earth,Ti, Mn, Pb, Au, U, Cr, W, V, Zn, Cu, Fe- ore	mining, engineering, armaments, chemical
Turkmenistan	6,7	488,1	Fe- ore, oil	mining

Tab. 2: Raw materials, industry and characteristics of the Caspian region States

In the Caspian region, there are significant mineral deposits, namely three percent of global oil reserves and seven percent of natural gas reserves. However, there are also other minerals well represented in the region, which are less known. These, in particular, include uranium, where Kazakhstan occupies the first place in the world, manganese, chromium, carbon, radium, arsenic, etc. Thanks to the set of all these circumstances, the region has become the center of interest of several global and regional actors. The European Union is just one of those actors interested in strengthening their position, whether through political or economic initiatives [24].

The relationship between the EU states and the Caspian region states

Germany, Europe's strongest economy and one of the strongest in the world, is a key partner in the development of relations between the EU and Middle Asia. The strong bilateral relationship between Germany and Kazakhstan is partially built on a historical basis, since at the end of the Soviet era, more than a million Germans were estimated to live in Kazakhstan [26]. At present, this number is significantly smaller, a little more than 200 thousand. The balance of trade in 2007 amounted to 5.6 billion €. Germany, despite the interest in investing in the energy sector, is looking for ways to strengthen its position especially in manufacturing, automotive, construction, electronics manufacturing, agriculture, management and education of skilled labor. Germany is one of the leading producers of gallium [30]. The policy of Kazakhstan, which supports the efforts of Germany to invest in other sectors such as energy, responds to this interest. Interest of Germany is based on the nature of its economy, in particular, small and medium-sized enterprises, which make up 80% of its economy. However, the attempt to penetrate into the region after being successfully established in Kazakhstan is also clear. The second largest trading partner in Central Asia is Uzbekistan, with whom the trade balance amounted to 329 million USD in 2007 [26].

The Italian economy is marked by strong regional contrasts, but in spite of internal economic disunity it is effective in creating functioning trade relations with foreign countries. Thanks to AGIP and its presence in the North Caspian Sea Consortium, Italy has become one of Kazakhstan's major trading partners. The balance of trade in 2007 amounted to 8.9 billion USD [24]. The cooperation takes place in various fields, from agriculture through light industry, food, or construction.

France, despite many common business characteristics with other European countries, has an important commercial position in Central Asia, mainly because of its reputation in the wine industry, the production of cheese, perfumes, cosmetics, clothing and luxury accessories. It is Kazakhstan's fifth trade partner [27].

Great Britain imports mainly raw materials such as steel, copper, wool, fertilizers, precious metals, and exports mainly products associated with the transformation of industry, innovation, scientific components, transportation equipment, hi-tech equipment, optics, chemicals, as well as food and tobacco. Great Britain is also trying to diversify its business activities through the development of technology and research centers [28].

The Netherlands also has a significant position in the Central Asian market. The Dutch economy is traditionally dependent

Country	Oil	Natural gas	Coal
	Share of total world [%]		
Azerbaijan	0,4	0,5	-
Iran	9,4	18,0	-
Kazakhstan	1,8	0,7	3,9
Turkmenistan	-	9,33	-
Russian Federation	5,2	17,6	18,2
EU	0,4	0,9	6,5
World	235, 8 thousand million tonnes	187,3 trillion cubic metres	860938 million tonnes

Tab. 3 Verified energy mineral resources the Caspian Region states and the European Union [25].

on foreign trade. One can say that this is the reason why the Netherlands started trading in new markets in the post-Soviet region, mainly due to taking advantage of its position as an air transport provider. Between 1993 and 2008, the Netherlands invested 39 billion USD in Kazakhstan. These investments are mainly in transport, communications, energy and the financial sectors [28].

Spanish economic growth heralds its great economic potential in the region, whereas mutual trade balance amounted to 906 million USD in 2007, which was twice that of 2005. Kazakhstan exports mainly raw materials and petrochemical products and imports foodstuffs, alcohol, tobacco, plastics, rubber, electronics. Sweden and Finland export mainly transportation equipment and telecommunications products, as well as timber and food products [28]. Central and Eastern European countries also have their share in the development of economic relations between the EU and the Caspian region. Slovakia and Slovenia are only marginally present in the region, but Bulgaria and Romania are greatly concerned about energy, particularly along the Caspian Sea-Black Sea axis. The most active partner of the Central Asian states of the EU region is Poland. Bilateral trade of Poland and Kazakhstan in 2007 amounted to 884 million USD. Poland is mainly interested in the construction, agriculture and chemical manufacturing. All countries of the region, however, have some common interests, particularly in the area of metallurgical and textile industries. From the perspective of the Central European States, the Central Asian region is interesting because of its potential for development [5].

Conclusion

States forming the Caspian region currently attract attention and arouse international interest mainly because of the high potential of mineral wealth in the region. As previously described, in the Caspian region there are significant deposits of oil, natural gas, coal, manganese, chromium and other important minerals. A key issue for exploiting mineral resources of the Caspian region is to resolve the legal status of the Caspian Sea i.e., "whom the Caspian Sea should belong to", or how the territory around the Caspian Sea should be divided in the future. The aim of the world powers is to solve this problem as soon as possible, and thereby the Caspian region could become a prospective area rich in mineral and energy resources. The European Union countries are directing their investments into the Caspian region, where they constitute potential markets for investment.

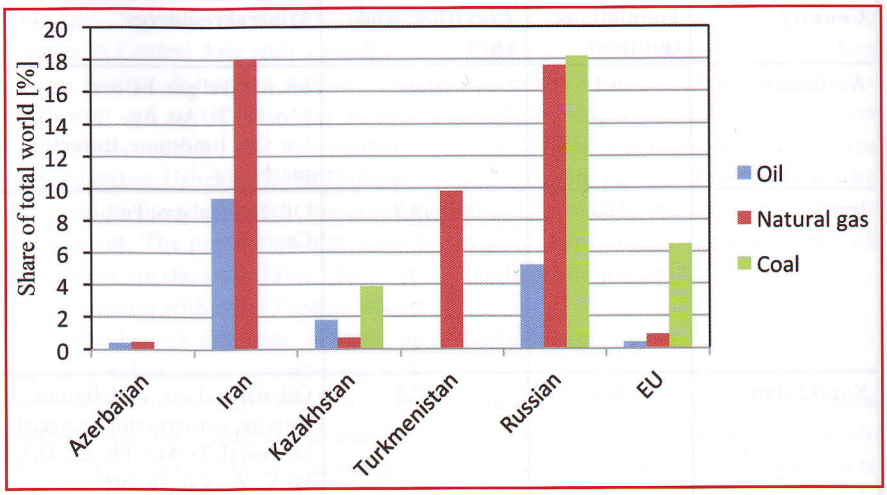

Fig. 2 Verified energy mineral resources the Caspian Region states and the European Union.

Currently, the largest investments are heading to Kazakhstan because it is the most advanced country in the region. Kazakhstan is also a producer of selenium, rhenium, titanium and vanadium. The second largest trading partner is Uzbekistan. Even Slovak companies are offered prospects of success in the markets of the Caspian region countries, in particular through exports of traditional products. However, competition in the region is very strong because China as the dominant producer seeks to obtain promising markets in the region. The future economic development of the Caspian region will be based primarily on prices of raw materials. Since this region is dominated by political, ethnic and religious diversity, its "reconciliation" will be the determining factor for the future development of the Caspian region, which will have a major impact on global economic developments. The EU countries are, however, those individual elements that make up the EU's overall relations with the Caspian region. Regarding trade, most investments go to Kazakhstan as economically most advanced country in the region. During his visit to the Caspian states, the ex-president of the Council of Europe Mirek Topolanek talked about strengthening bilateral trade and energy supplies from the EU and compared one of the options for enhanced cooperation, the so called "Southern Corridor", to the modern version of the Silk Road, adding that Central Asia would not only secure oil and gas supplies to Europe, but that people, goods, investment and information should flow both ways [29]. The Prime Ministers and Governments representatives of the three Caspian countries have expressed their interest in cooperation and are now waiting for clear signals and concrete offers of assistance from the EU

Acknowledgements

This work was supported by Ministry of Education of the Slovak Republic under grant VEGA MS SR 1 10293114. This publication is the result of the Project implementation: University Science Park TECHNICOM for Innovation Applications Supported by Knowledge Technology, ITMS: 26220220182, supported by the Research & Development Operational Programme funded by the ERDF.

References

[1] M. Rene.: Actual problems of Geology 3, Search, survey and valuation of mineral resources, Prague. (2007) http://www.geology.upol.cz/Soubory/Aktualni_problemy_geologie_3_1.pdf
[2] P. Balaz., D. Kusik: Slovak Minerals Yearbook, first ed., SGIDS Spisska Nova Ves- Bratislava (2011), p.155
[3] Kalyuzhnova Y.: The EU and the Caspian Sea region: An energy partnership? Economic Systems 29 (2005) 59–76
[4] Michigan State University. Doing Business in Central Asia. www.globaledge.msu.edu. (2010)
[5] J. Boonstra, J. Hale: EU Assistance to Central Asia: Back to the Drawing Board? 2010. EUCAM EU-Central Asia Monitoring, http://www.ceps.be/book/eu-assistance-central-asia-back-drawing-board (2010).
[6] Critical raw materials for the EU, Report of the Ad-hoc Working Group on defining critical raw materials July (2010), http://ec.europa.eu/enterprise/policies/raw-materials/files/docs/report-b_en.pdf
[7] M. Rene: Needs analysis of mineral raw materials is not raw material policies of the EU. Odpady. N 1. (2013) p. 26-27

[8] M. Nowakowska, Defining Critical Raw Materials in the EU: Information Gaps and Available Solutions. US-EU Workshop on Mineral Raw Material Flows & Data Brussels, 12 September (2012), http://ec.europa.eu/enterprise/policies/raw-materials/files/docs/eu_us_critical_raw_materials_en.pdf
[9] Communication from the commission to the European parliament, the council, the European economic and social committee and the committee of the regions. Tackling the challenges in commodity markets and raw materials. Brussels, (2011)
[10] S. Horak.: Central Asia between East and West. Univerzita Karlova – Praha, (2005), p. 260
[11] I. B. Ezijev: Geopolitika Kaspijskogo regiona. Moskva, Adalus.(2007)
[12] E.Soulejmanov: Geopolitics of the Caspian Region. The International Policy, Vol.27. N. 9. (2003). p. 10-14.
[13] M. Ondrejcik: The legal status of the Caspian Sea. http://www.despiteborders.com/clanok.php?subaction=showfull&id=1224228035&arc
[14] K. S. Gadzajev: Geopolitičeskije gorizonty Rossii: kontury novogo miroporjadka. first ed. Moskva: Ekonomika, (2007). p. 751
[15] Caspian sea, map. (2014), http://www.worldatlas.com/aatlas/infopage/caspiansea.htm
[16] Honorary consulate of The Republic of Azerbaijan in Slovakia, (2014), http://azconsulate.sk/azerbajdzan/geografia/
[17] Azerbaycan Respublikasi Konstitusiyasi. (2010), http://stracker.bos.ru/azlaws/0000.html
[18] Caspian Energy,(2010), http://www.caspenergy.com/framee.html.
[19] Brown T.J. at all: World mineral production 2007-11. British Geological Survey, Nothingam, p. 85 (2013)
[20] Economics and information material-Islamic Republic of Iran. MFEA SR, p. 20 (2013), http://www.mzv.sk/App/wcm/media.nsf/vw_ByID/ID_10EF5F68542D8C21C1257676004811B3_SK/$File/110427_Iran_ZIT_2011.pdf
[21] Economic information on the territory. Republic of Kazakhstan. MFEA SR, p. 18 (2014)
http://www.mzv.sk/App/wcm/media.nsf/vw_ByID/ID_EE07B4AD73276B0DC125783B004793C5_SK/$File/131016_EIT_Kazachstan.pdf
[22] E. Idrissov.: Relations of the European Union to Kazakhstan must be developed. Oil is not the future. (2013), http://www.euractiv.sk/energetika/analyza/vztahy-eu-kazachstan-sa-musia-vyvinut-ropa-nie-je-buducnost-020650
[23] Economic information on the territory. Turkmenistan. MFEA SR, p. 9 (2012), http://www.mzv.sk/App/wcm/media.nsf/vw_ByID/ID_4827FF2B43F3E904C12578EF00498925_SK/$File/121204_EIT_Turkmensko.pdf
[24] M. B. Olcott: Central Asia's Second Chance. first ed. Washington: CEIP, 2005. 390 p.
[25] BP Statistical Review of World Energy June 2013, str. 48 (2013), http://www.bp.com/liveassets/bp_internet/globalbp/globalbp_uk_english/reports_and_publications/statistical_energy_review_2011/STAGING/local_assets/pdf/statistical_review_of_world_energy_full_report_2012.pdf
[26] Ministry of foreign and European Affairs of the SR, (2010), www.mzsr.sk
[27] Peyrous, S.: Business and Trade Relationships between the EU and Central Asia, (2010) www.fride.org
[28] Caspian Business News, (2010), http://www.caspianbusinessnews.com/c_issue.php
[29] Topolánek: Caspian Region has enough raw materials and is willing to supply EU.(2013), http://www.eu2009.cz/en/news-and-documents/news/topolanek-caspian-region-has-enough-raw-materials-and-is-wil-9533/index.html
[30] Brown, T.J.:. World mineral production 2008-12, British Geological survey (2014), Nothingam p. 126

(1) Martina Laubertová, Klaudia Šándorová, Technical university of Kosice, Faculty of Metallurgy Department of Non Ferrous Metals and Waste Treatment, Letna 9, Kosice, Slovakia, e-mail: martina.laubertova@tuke.sk

Stark und widerstandsfähig seit 40 Jahren

Der Name Hardox ist längst zum Synonym für Widerstandsfähigkeit geworden. Seine weltweit führende Marktposition ist nach 40 Jahren stärker denn je. Bei SSAB zählt Hardox zu den erfolgreichsten Produkten der Unternehmensgeschichte.

Mit der Einführung von Hardox vor 40 Jahren wurde das Ziel erreicht, ein Verschleißblech zu entwickeln, das stärker und widerstandsfähiger als alle anderen Stähle auf dem Markt war. Es musste hart genug sein, um enormem Verschleiß auch über einen langen Zeitraum zu widerstehen, und strapazierfähig genug, um beim Biegen und intensiven Einsatz nicht zu reißen. Bei seiner Einführung 1974 als „biegbares Verschleißblech" war der neue Werkstoff das erste Verschleißblech der Welt, das einen hohen Härtegrad mit Widerstandsfähigkeit vereinte und zudem gut als Konstruktionsstahl eingesetzt werden konnte. Das Produkt konnte seither für immer anspruchsvollere Anforderungen weiterentwickelt werden. Aus diesem Grund ist Hardox im Segment der Verschleißbleche immer noch führend.

Für die Entwicklung der Hardox Stahlgüten war entscheidend, dass sie nicht nur widerstandsfähig sind, sondern auch als Konstruktionsstahl angewendet werden können. Aus Hardox entstehen mittlerweile auch dünnwandige und leichte Lkw-Aufbauten, Container und Baggerschaufeln, die gleichzeitig hohem Verschleiß widerstehen. Aufgrund des Interesses von Kunden am Markennamens Hardox beim Vertrieb von Lkw-Aufbauten, Baggerschaufeln und anderen Endprodukten entwickelte SSAB das Konzept von Hardox In My Boby.

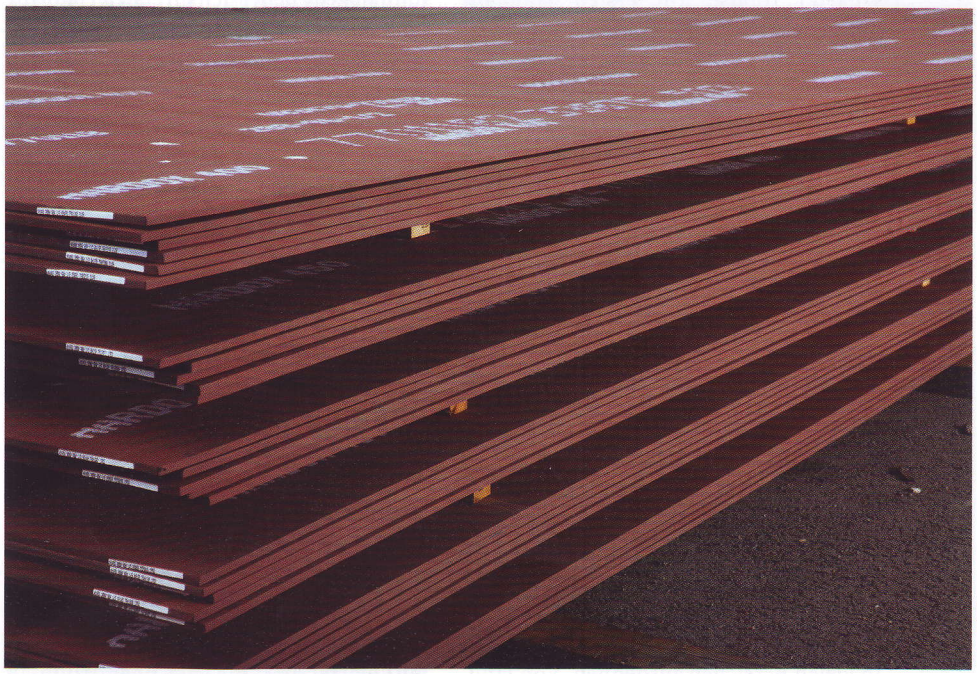

Foto: SSAB

Hardox Bleche, fertig für den Einsatz in einem Muldenkipper, Container oder Baggerschaufel irgendwo auf der Welt.