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ANALYSIS OF NON-TRADITIONAL TYPES OF ALUMINUM-CONTAINING RAW MATERIALS, FOR WHICH THERE IS EXPERIENCE IN PROCESSING TO OBTAIN PRODUCTS FOR METALLURGICAL AND OTHER PURPOSES

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Abstract
A comparison of the composition of mineral concentrators obtained from non-bauxite ores of various types (Figure 1.9) shows that the highest Al2O3 content is achieved in concentrators made of kyanite shale, which deserve attention as an ore for aluminum in the first place [35]. Of the listed types of mineral concentrates for the production of alumina and aluminum, kaolin-containing sands, anorthosites, andalusite-kyanite-silymanite rocks, ash from the combustion of coals from thermal power plants (CHP), and others are widespread in the Far Eastern region of Russia [35]. Clay rocks have a variety of applications, but kaolinite ores are undoubtedly the most valuable and attractive for alumina production due to the high content of Al2O3 (up to 39.5%) and the formation of significant deposits with a limited amount of impurities inherited during the leaching of aluminosilicates in the composition of primary igneous rocks
Kaolin raw materials in nature are represented by three types: primary kaolin, secondary kaolin and quartz-kaolinite-containing sands.

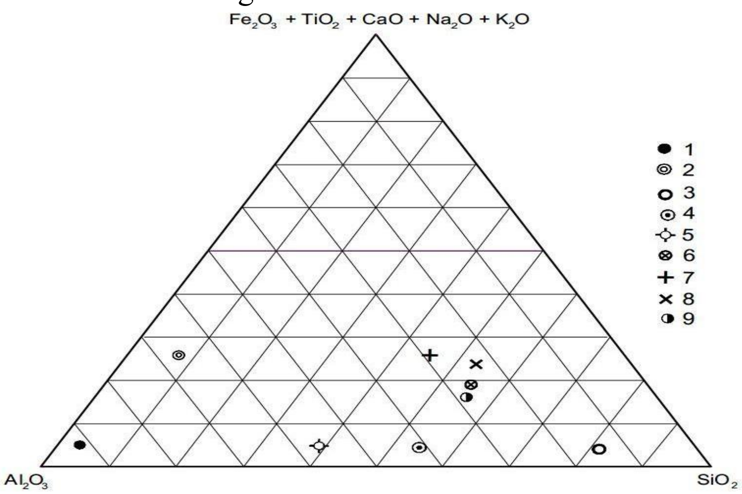

Figure 1.9 - Diagram of the average compositions of mineral concentrators of alumina of various types, wt%, where: 1 – high-quality Guinean bauxite;

2 – Ural bauxite; 3 - quartz-feldspar kaolin-containing sands of the Chalgan deposit (Amur Region); 4 – kaolin concentrates of the experimental and technological branch of the Amur Research Center of the Far Eastern Branch of the Russian Academy of Sciences; 5 – kyanite concentrates from the Novaya Shuurta deposit (Kola Peninsula); 6 – anorthosites of the Kalar massif; 7 – nepheline concentrates of the Khibiny deposit (Kola Peninsula); 8 – synnyrite ore of the Sakunskoye deposit (Chita region);
9 – ashes of the Ekibastuz coal basin (Kazakhstan) [35]
Primary kaolin (eluvial, residual) is the end product of weathering of feldspar (igneous and metamorphic) rocks. The color of kaolins is usually white, light gray or yellowish. They are often contaminated with impurities of undecomposed parent rock. Kaolin deposits have a plasto- and lenticular shape and sometimes reach several tens of square kilometers in plan. The thickness of the deposits varies from centimeters to several tens of meters. They are on watershed plateaus of ancient leveled surfaces confined to the upper (kaolin) zone of the weathering crust and are connected with the parent rocks by gradual transitions. Deposits of this type (Prosyanovskoye, Glukhovetskoye, Velikogadomskoye in Ukraine, Zhuravliny Log and Kyshtymskoye in Russia, Alekseevskoye and Soyuznoye in Kazakhstan) form the basis of the raw material base of kaolins in the CIS.
In terms of chemical and mineral composition, primary kaolins of residual deposits are divided into alkaline-free or normal (Glukhovetskoye, Alekseevskoye) and alkaline. Alkaline kaolins make up both entire deposits (Dubrovskoye) and their individual parts (Prosyanovskoye). They differ from normal kaolins in the increased content of alkalis and the size of the potassium modulus, which is 15-20 times higher in alkaline ones. The K_2O content in alkaline kaolins ranges from 1.5 to 6.0%, while in others it does not exceed 0.5%. Alkaline kaolins contain a significant amount of relict microcline grains, which makes it possible to obtain feldspar concentrate during beneficiation as well.
Examples of primary kaolin deposits are the Prosyanovskoye and Glukhovetskoye deposits. The Prosyanovskoye deposit is the remains of an ancient weathering crust (kaolinization) on igneous rocks of the granite series. The thickness of the developed deposit varies within a wide range - from 1 to 50 m. Kaolins are overlain by modern deposits - a thickness of sandy-clayey rocks up to 20 m thick. Impurities are compounds of iron, titanium, sulfate, mica and organic substances. The Glukhovetskoye deposit is represented by one powerful deposit. Mineral composition of the ore: up to 60.0% kaolinite, up to 39.5% quartz, 0.5% limonite.
Secondary kaolin (sedimentary or redepositional) is formed as a result of erosion and redeposition in the aqueous environment of kaolinite matter of primary (residual) kaolin deposits or products of kaolin weathering. They are distributed in the areas of development of primary kaolins, but are often remote from the latter at a considerable distance. Deposits are represented by strata, bed-like or lenticular deposits among sandy deposits several square kilometers with a thickness of up to several tens of meters (Vladimirovskoye, Polozhnoye, Novoselitskoye deposits). Secondary kaolins are characterized by high plasticity, refractoriness, mechanical strength, and often have an increased content of Fe_2O_3 and TiO_2.

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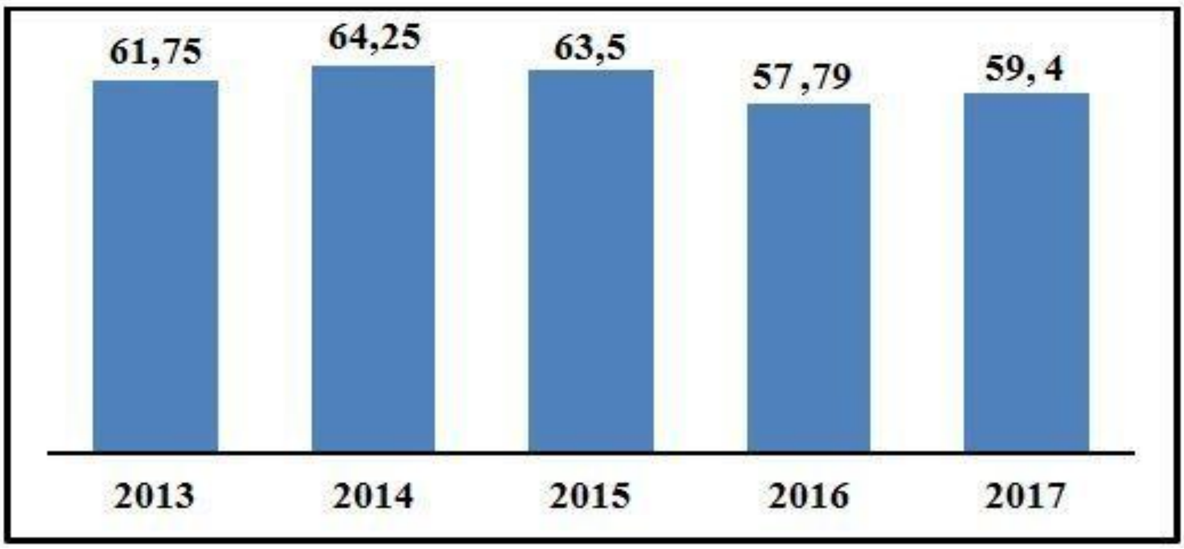
To obtain kaolin concentrate, quartzkaolinite-containing sands can be used - sandy sedimentary deposits of various genesis, enriched with kaolinite substance. Their deposits usually have a bed-like shape and an area of several tens of square kilometers.

Power Sands Can reach Dozen Metres away (deposits Chalgan, Gyzylgay).

The world volume of reserves of kaolinite clays and all types of kaolin is estimated at 20–25 billion tons, of which kaolin raw materials are about 16 billion tons, its consumption is quite stable and is currently at a level of 60 million tons per year (Figure 1.10)

Figure 1.10 - World indicators of kaolin raw material production, million tons / year [36



About 2/3 of the world's reserves of kaolin raw materials fall on several countries (Figure 1.11)

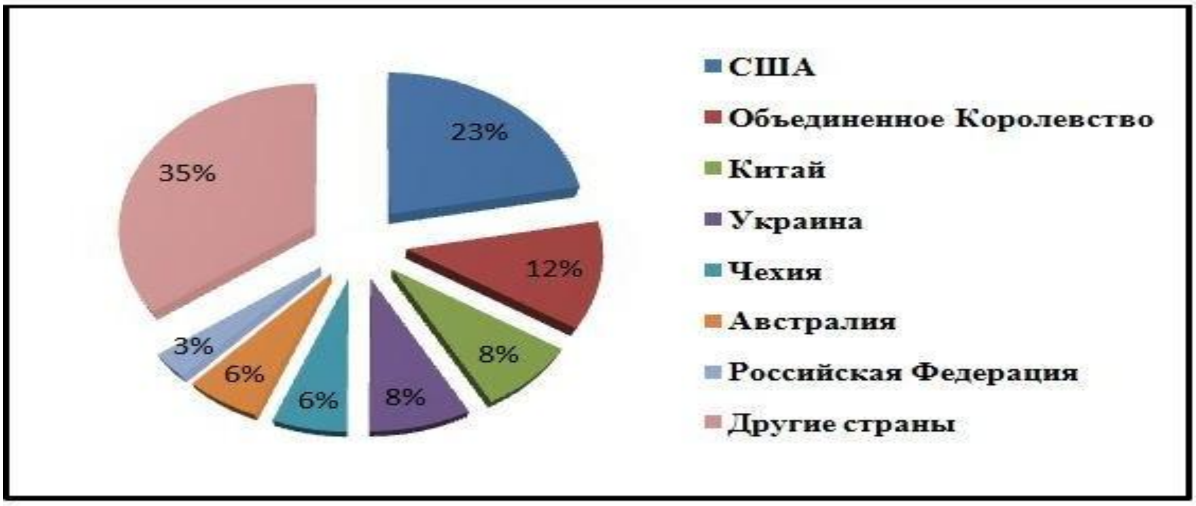


Figure 1.11 - Distribution of kaolin stocks by countries of the world

India, Korea, and Spain can be added to the number of countries given in Figure 1.11. Like other mineral resources, this raw material is distributed quite unevenly in the earth's crust and across countries, which puts some in the privileged, and others in the disadvantage. Paradoxically, Russia, the largest country in the world, accounts for only 3% of the world's kaolin reserves.

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