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EXPLOITATION OF HUNGARIAN MINERALS

PLANS FOR DEVELOPING HUNGARIAN INDUSTRIAL MINERALS

Viktor Bauma

My lecture deals with the mining and utilization of industrial minerals, with the exception of ores, coal, petroleum and salt /the original did not indicate the occasion, date, or place of the lecture/. I wish to call attention to those minerals which are important key materials for heavy industry and other industrial enterprises. Some of our minerals are obtained by foreign mining industries which, with the help of their highly developed methods, make them usable. In turn, these materials are brought back to Hungary as semi-finished products.

Hungary's mineral deposits satisfy almost all the requirements of the domestic industries. If, in the future, the hitherto neglected minerals are treated and developed commensurate with their importance, not only can our imports be reduced greatly, but substantial exports can be achieved. In the majority of cases, the quality of domestic raw materials is not inferior to that of foreign materials but due to more perfect processing abroad, domestic minerals cannot compete on the world market.

Only prior to the last war did the Hungarian government turn its attention to the problems of domestic raw-material deposits, but no constructive measures were taken at that time. As to the domestic deposits of kaolin and refractory clay, paper factories and the Zsolnay Ceramics Works strived to reduce the volume of import by using Hungarian raw materials. Greater efforts were made in connection with the kaolin deposits at Mad and Szeg, and the requirements of the paper factories were gradually satisfied. Quartzites, found at Gyongyos and Mad, were utilized for silica brick manufacture, and importation of this material was reduced.

In 1942, domestic bentonite appeared on the market, mainly as a filler for soaps to alleviate the shortage of sebacic acid. Foreign bentonite was also imported and offered as binder for the use of foundries. In addition, foreign countries turned their attention to Hungarian bentonites, and large-scale preparations for raw bentonite export had begun.

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After the liberation, mining of industrial minerals was controlled by 20-30 small enterprises which did not think of substantial investments. By 1949, it became evident that mineral mining, due to unsystematic exploitation, could not keep pace with the development of heavy industry. As a result, an enterprise was created by the National Planning Bureau to exploit these key raw materials. In 1950, experiments were conducted, and raw material deposits deemed to be economical for exploitation were registered.

The following is an outline of the present status and possible future development of Hungarian industrial-mineral mining:

Refractory clay is one of the most important prerequisites of the rapidly growing heavy industry. During the past decades, requirements were fulfilled almost exclusively by imports, and only the difficulties connected with importation led to the exploitation of domestic refractory clays. Deposits with high refractory properties were found in undetermined segments in the vicinity of Pilis and these are reserved for the use of foundries.

Clay with mediocre refractory properties was located in large deposits only near Felsopeteny but the quality, contrary to expectations, was found to be inferior, due to the pyrite content of the deposits. Since similar difficulty may be expected in the future, adequate processes leading to the reduction of the pyrite content must be used.

Mediocre refractory clays are also being mined at Bajna, Csakbereny, Csersztegtomaj, Annavolgy, and Sumeg. At these localities, there are clay deposits free of pyrite, but serious research has not been accomplished. At present, drillings are being conducted at Csakbereny, Bajna, and Sumeg to determine the extent of the deposits.

Another important refractory clay, a refractory kaolin known as liparite, will play a significant role in the immediate future. Domestic refractory kaolins are aluminum hydrosilicates, which, due to their comparatively high alkali content, help the formation of mullite. This effect is augmented by high-temperature roasting as well as by even dispersion due to fine grinding. Although the fusion point of refractory kaolin is rated only 30-31 Sk /probably same as PCE, i.e., Pyrometric Cone Equivalent/, yet the softening point of brick made of liparite by fine grinding and roasting (Ta equals 1,420 degrees, Te equals 1,570 degrees at 2 kilograms per square centimeter) is equal to the softening point of first-quality refractory brick, or Seger 34-35 degrees.

The experiments were successful, and large-scale mining and roasting of refractory kaolin may be expected in the near future. There are large kaolin deposits available, especially at Ond, near Szerencs. The location of other large deposits at Monok is unfavorable.

Another important refractory substance is a special quartzite, the raw material of silica bricks. During the past decades, manufacture of silica bricks was inconceivable without foreign quartzite, but import difficulties induced the exploitation of domestic quartzites. The result is that Hungary now exports silica bricks manufactured exclusively of domestic quartzite.

Telleric quartzite, found at Gyongyos, is suitable in itself for the manufacture of silica brick, while hydroquartzite, mined at Mad and in the vicinity of Tokaj, can only be used in blended form. Quartzites at Velence (Pazmand) and quartz sandstone at Kovagoors are of less importance yet indispensable because of their good quality. Quartzite mining at Gyongyos and Mad was primitive, and substantial investments were necessary to insure increased production. Quartzite found at Gyongyos contains a high percentage of barite which had to be eliminated.

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Large quantities of quartzite necessary for the manufacture of ferrosilicon are supplied by deposits at Kovagoors and Mad. Currently, experiments are also being conducted with quartzite found at Felsotarkany.

Foundries need high-refractory quartz sand, 10-15 percent blended with refractory clay. For this purpose, quartz sand at Sarisap and its environs is being utilized with gratifying results. Mining of this material, however, has been inadequate, necessitating the construction of extensive industrial sidings which will soon be in operation.

An entirely new refractory raw material was detected in the siliceous earth near Erdobenye. The fusion point of the purer particles of this material is rated at 31-33 Sk, while the average rate is 29 Sk. This substance, composed of very fine grains, has great binding capacity, and is eminently suitable for the manufacture of the fire-proof bricks, according to the method of Dr Janos Albert. With the exploitation of this raw material it would be worth while to inaugurate the manufacture of fireproof bricks, which would result in substantial exports. Mining of this material, however, has hardly begun, although export possibilities are being studied.

The supply of quartz sand is of great importance for heavy industry and glass manufacture. It is a well-known fact that the foundries are the worst bottleneck of Hungarian heavy industry. Since the exploitation of old sandpits was discontinued, new sand deposits had to be found. Large deposits discovered recently at Bukkosd and its vicinity are of excellent quality, and can supply most of the sand necessary for the processing of synthetic sand. Here, mining equipment is being installed together with industrial sidings.

Unfortunately, the problem of producing iron-free sand for the glass industry has not yet been solved; thus, manufacture of high-quality glassware is feasible only with imported sand. Substantial improvement may be expected by the sedimentation of sand containing kaolin binder, found at Sarisap. Currently, sand for glass manufacture is being supplied by mines located in the vicinity of Lake Balaton.

Bentonite, used as binder, is an important auxiliary material for the synthetic sand which is being introduced in Hungary. The principal component of bentonite is montmorillonite; this substance is capable of fine dispersion not only in wet but also in organic substances. Another property of montmorillonite is its high capacity for cation exchange.

According to cation content there are alkali bentonites which immediately expand in water and calcium bentonites which show a considerably lower rate of expansion. Alkali bentonite as sand binder has a greater value, but according to the results for foreign experiments, calcium bentonites are also usable. Hungary has only calcium bentonites which are being activated or transformed to alkali bentonites for the use of foundries.

Bentonite, which is one of the most valuable domestic minerals, is found at many locations. Domestic bentonite is actually an inorganic glue. In a quantity of 4-5 percent, it insures a degree of hardness for the casting sand which would only be possible with sand of 25-30 percent clay content. Since the gas-dissipating quality in foundry sand cores is of utmost importance, it is evident that 4-5 percent bentonite insures a much larger dissipating quality than 25-30 percent clay content.

In addition to bentonites found in the vicinity of Mad (Ratka, Koldu), as well as at Komloska, bentonite deposits were detected at Band. Experiments showed that large amounts of precipitants found at Nagteteny could also be used for foundries. At present, mining is under way also at the bentonite deposits at Monok and Telkibanya.

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Bentonite is also important as a sizing agent for textiles. As a domestic innovation, bentonite has been used as a substitute for starch, which has resulted in considerable saving, and will also increase the possibility of bentonite export. Hungarian bentonites of light color occupy an eminent place on the world market, although they cannot compete with US bentonites.

Another important auxiliary substance connected with synthetic sand processing in foundries is refractory clay. As a consequence of heat developing during the smelting process, the quartz sand expands, and the resulting thermal expansion can be equalized only by the addition of refractory clay. According to the experiments of Andras Toth and his associates, only the refractory clay found at Pilisszentivan proved to be adequate. Unfortunately, this excellent but rare material must be reserved exclusively for the use of foundries.

The fine ceramics industry is faced with an unsolved problem namely, the establishment of a precipitated kaolin industry. Kaolin found at Mad and Szeg has relatively small sand content. In contrast to Czech kaolin, containing 70-75 percent sand, the Mad and Szeg kaolin possesses only 10-15 percent. While the Czechs use the expensive process of sedimentation, a more economical method, grinding of quartz sand, was adopted in Hungary.

The kaolin mined at Mad and Szeg as well as the grinding mills, satisfy the requirements of the paper industry. Utilization of raw kaolin for paper manufacture has also begun. For decades, Czech kaolin had a dominating position until, due to the efforts of Dr Janos Berna, precipitation of raw kaolin was begun in the paper industry. At first, the paper factories declined to use this method, but later they recognized the economy resulting from the sedimentation process. Kaolin dispersion, thus obtained, makes the addition of kaolin binder to paper easier. Fresh kaolin dispersion has a higher absorption capacity than the ground or sedimented kaolin which has previously undergone the drying process.

Sedimented kaolin, however, used as the basic raw material in the fine ceramics industry, is still being imported. Based on my experience gained in connection with the sedimentation of kaolin mined at Egeres (Transylvania), I found a raw material in the sand containing kaolin binder at Sarisap (Transdanubia), which, from the quantitative as well qualitative viewpoint, may be the foundation of a domestic precipitated kaolin industry. According to my calculations, the quality of the Sarisap quartz sand with 20-25 percent kaolin content, nearly equals that of the sedimented Czech kaolin which is so eminently suitable for the manufacture of pottery and porcelain. The National Patent Office is considering my innovation, and if the planned sedimenting plant is established, most of the requirements for precipitated kaolin could be satisfied in the near future without imports. In addition, the Sarisap quartz sand is also suitable for glass manufacture. Experiments have already shown gratifying results. It is quite possible that with the sedimentation of the Sarisap sand, the volume of imports could be reduced substantially.

In 1950, experiments were conducted relative to talcum (magnesium hydrosilicate) found at Felsocsatar. Unfortunately, the quality of this talcum deposit is varied light and more valuable segments are missing. It also possesses a high lime carbonate content and iron-oxide impurities. Mining of talcum at Felsocsatar requires detailed and highly technical selection, and its quantity is still negligible.

Aplite found at Szekesfehervar is utilized as a feldspar substitute by the ceramics industry. Unfortunately, deposits with small iron-oxide content are rare, and the industrial requirements can be satisfied only by highly technical selection.

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Several million tons of gypsum in 10-[illegible]-meter-thick layers were detected in the vicinity of Perkupa. However, the deposits are blended with dolomite and anhydrite. Evaluation of the deposits will be feasible only in the middle of the year, when mining will be begun.

For the requirements of the metallurgy and sugar industries, limestone is of great importance. Unfortunately, the available mining installations are inadequate, and improvements entail great difficulties. Although the limestone at Felnemet and Szalonna is excellent, mining without adequate equipment may impair its quality.

Concerning limestone, the various lime-tuff and chalkstone deposits are of great importance for soil improvement and fodder. Experiments with lime tuff for soil improvement, conducted by Oszkar [illegible], have shown that when frozen, it becomes pulverized to a great extent and thus suitable for use without grinding. Deposits at Nagyteteny and Zebegeny are of satisfactory quality but require extensive grinding facilities which are not yet available.

Dolomite requirements of the pottery and glass industries are fulfilled by the excellent deposits located in the vicinity of Budapest. Dolomite mines at Lillafured in the Bukk Mountains supply our metallurgy with dolomite of good quality. As to its components, the dolomite at Szin, near Szodliget, is similar to that of Jolsva.

There are barite deposits of adequate purity in the vicinity of Sukuro, but their quantity is negligible, and the yield amounts to a few car loads only.

Recently, introduction of domestic hydraulic cement binders (pozzuolanic cement) proved to be important. To regulate the utilization of specific varieties of cement and avoid the use of higher-quality cement when lower quality is satisfactory, ground pozzuolanic binders were blended with cement. Rhyolite tuff, with its 55-56 percent soluble siliceous earth content, is the best available hydraulic binder. Mining at Ratka has been begun, and a large grinding mill is under construction.

Emphasis is also placed on the transformation of minerals into semifinished products. Research activities and mechanization of mines will be continued, but satisfaction of important industrial requirements, reduction of imports, and possibility of export will have to wait until a higher level of production is attained.

In connection with processing, grinding is of paramount importance. Kaolin, refractory clay, bentonite, and siliceous earth are now being shipped in powdered form. However, grinding facilities have never been available in sufficient number and are also obsolete. Even the makeshift grinding mills of private enterprises were, in the course of nationalization, divided between the various industries, and the mining industry was allocated only one grinding mill at Budapest and two in the country. Drying preliminary to grinding was carried out on a small scale by these establishments, using an obsolete method, while the more modern drying installation at Szeg is in a deteriorated condition.

Acquisition of new grinding mills constitutes a difficult problem. Orders for domestic grinding installations are filled with considerable delay. Attempts are made to increase the capacity of the mills by the old-fashioned grindstones. As a result, grinding achievements were increased by 40 percent at Budapest and Mad. Enlargement of the Budapest grinding mill is under way, while expansion at Mad will be begun shortly. These establishments are temporary, since erection of modern, large-capacity drying, classifying, and grinding mills at both locations is being planned. A grinding mill of considerable capacity for the

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reduction of the pyrite content will be built at Felsopeteny, and another mill will be erected near Nagytetny to grind lime for fodder and soil-improvement purposes. It may be mentioned that a great number of complaints has been received in connection with shipping of powdered materials.

Production of powdered bentonite of great binding capacity requires special processing. US bentonite is the best on the world market. While the US natron bentonites expand in water and attain substantial binding capacity, our calcium bentonites attain the necessary binding capacity only after activation.

On the suggestion of Dr Janos Barna, a bentonite committee was created in 1949, which succeeded in finding a process by which domestic bentonites will attain the binding capacity of US bentonites. Unfortunately, acquisition of the installations necessary for this process is difficult and cannot be accomplished in a few months.

Drying of bentonite is another special problem, because it is feasible only within narrow heat limits due to its sensitivity. Since the necessary equipment cannot be acquired within a short time, a drying method by revolving drums must be used. Two installations of great capacity employing this method are already in operation at Budapest and Mad.

Activation of bentonite will be accomplished in water, and for this purpose, special mixing and rolling equipment can be secured.

Utilization of bentonite is also important in connection with the increase in the plasticity of the poor, domestic refractory and fine ceramics raw material. In this respect, innovation was achieved by the Bauma-Barna process. According to the experiments, with the addition of a few percent bentonite, the molding capacity of the very poor foreign and domestic shale was increased without the loss of their refractory properties.

Important research is being conducted on decreasing the pyrite content of the raw materials found at Peteny which are used for the fine ceramics industry and the manufacture of refractory clay. Mining of materials containing rich pyrite is being discontinued there. Unfortunately, this preventive measure and application of selective mining still cannot eliminate entirely the presence of pyrite. An innovation, worked out by Dr Antal Kovach, consists of rough grinding and sifting of the raw material; the larger particles contain the bulk of the pyrite. Experiments proved that the fine, granulated pyrite which remained in the raw material cannot cause damages. Using this method, approximately 20-25 percent of coarse particles were left, from which the remaining clay content may be derived by sedimentation. Practical utilization of this method, invented by Kovach, is under consideration.

For the use of fine ceramics, reduction of the pyrite content of Peteny clay is equally important. Because of its granular structure, this clay is the best material for pottery. Unfortunately, the clay which was previously obtained at Peteny and which could be burnt white is no longer available. Clay still to be found there contains 1.5 percent iron oxide and occasionally some pyrite. However, even fine pyrite granules may cause serious damage to fine ceramics and are, therefore, unsuitable for the manufacture of first-grade products.

An innovation in connection with the manufacture of the Peteny clay for fine ceramics was worked out by Gabor Galdy. According to this method, the pyrite content is removed by sedimentation at a central plant, if possible. Subsequently, the clay dispersion is blended with raw material of poor quality to make sieving through mud presses easier. Thus, a basic mixture for fine ceramics can be obtained; it may be further blended according to the special requirements of the various factories. Practical use of this innovation is difficult but is under consideration.

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Another important process concerns reduction of the barium content of quartzite found at Gyongyos, which is the sole domestic quartzite suitable for the manufacture of silica bricks. For the transformation of quartzite, 4-5 percent of barium carbonate content is favorable, but a larger percentage, sometimes reaching 15 percent, is detrimental. Due to this higher percentage, not only the quality of the silica brick but also its specific gravity and SiO_2 content are endangered. Since properties of the silica brick are determined by international standards, they cannot be changed in export transactions.

As to export possibilities, the first place is occupied by the bentonites. Although US, Italian, and French bentonites offer stiff competition, great interest exists for Hungarian bentonites, esp ally in Poland. Exports to Poland have already begun, but due to our lim d grinding capacity, the quantity is limited. On an experimental basis, several carloads of bentonites were also sent to East Germany, and larger orders are expected. Foreign interest is manifested for siliceous earth. Shipping of siliceous earth in raw-material form is disadvantageous, and grinding difficulties are also present.

Another export item is the raw Teteny precipitant, and shipments continue regularly. Export of pumice stone mined at Tokaj has also begun to South America. This substance is eminently suitable for the manufacture of polishing materials and grindstones.

Finally, I wish to call the National Patent Office's /sic/ attention to reports pertaining to previously unknown deposits. Some of these reports have been neglected for a long time.

COMMENTS ON VIKTOR BAUMA'S LECTURE

Dr Tibor Szalai

The importance of research and exploitation of industrial raw materials was recognized by the Institute of Geology as early as 1945. In 1948, at the centennial celebration of the Hungarian Geological Association, the general conclusion was reached that research of classical mining materials in Hungary is unpromising; therefore, our attention must be directed to research of industrial mineral raw materials, water, and water power.

Research for trass was conducted by Jasko, L. Simanyi, and S. Varga. Tests for the chemical and physical properties of trass, which is found in substantial quantity near Satoraljaujhely, proved that this material is of good quality.

Research operations for aplite, barite, and fluorite are being conducted. Based on Jantsky's explorations, a large quantity of aplite was discovered.

Fuller's earth and bentonite research is also in progress, and Jozsef Frits if to be commended for these operations.

Deposits of cement marl, dolomite, limestone, and lime tuff are being explored; dolomite deposits with over 25-percent magnesium content have been discovered.

Sand research for glass manufacture and foundry use has been conducted with practical results by Sumeghy and Mihaltz, and mineral-pigment, glauconite, and perlite research also led to successes.

Prospects for basalt mining are encouraging; basalts located near the coal-mining areas, lend themselves to the establishment of a basalt-smelting industry. Smelted basalt is characterized by its corrosion- and acid-resistant properties which determine its industrial utilization. Millstones made of smelted basalt can be cast in a few minutes. Since the hardness of the basalt is rated at 8-9 on Moh's scale, thus being almost as hard as corundum, it is eminently suitable for casting of abrasive discs, etc. Due to its great wear-resistant

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properties, it can also be used for linings on easily corroding pipes, exhausts, coal chutes, and coke ovens; its acid-resistant properties also make it suitable for the manufacture of acid-resistant containers and precipitant tanks in the tanning, cellulose, and textile industries.

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