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MOLYBDENUM DEPOSITS IN THE USSR

/Numbers in parentheses refer to appended sources./

General

Molybdenum has come into wide use only in the present century. Production in 1913 was 162.2 m /metric tons/ compared with 14,835 m /metric tons/ in 1938. The rapidly increasing use of molybdenum in industry is a direct result of its capacity to increase the mechanical qualities of manufactured products. Broad application of molybdenum steel is made in the military, automotive, aviation, instrument, chemical, electrical, and other industries.

The increasing demand for molybdenum is satisfied at present /1946/ from various types of deposits, both of pure molybdenum and of complexes. Therefore, the industrial content of the metal in ores varies within wide limits. To the category of high-grade ores belong those having a molybdenum content of 2-3 percent. More abundant and more widely exploited deposits contain about 0.6-1 percent. Complex deposits permit a recovery with a content of 0.2-0.3 percent. Finally, in the copper ores of the impregnated type, where molybdenum is a secondary mineral, its content varies from hundredths to thousandths of one percent.

All molybdenum ores undergo enrichment through smelting. Flotation permits a concentration with a content of 95 percent molybdenum flash.(1)

Molybdenum is found in many places in the USSR. The most important deposits are situated in the Transbaykal, in the Khibinsk tundra on the Kol'skiy Peninsula, in western Georgia, in the Il'men Mountains (Urals), and in other places.(2)

Hydrothermal deposits of molybdenum are at present /1946/ almost the total source of extracted molybdenum. A large part of the hydrothermal deposits consist of the hypothermal type, but several are transitional from hypothermal to mezothermal.

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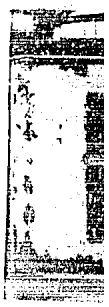

Among the hypothermal deposits the following types predominate:

a. A complex molybdenum-tungsten type of mineralization, combined with skarn. The industrial significance of this type is becoming apparent as a result of the prospecting work of recent years. Representative of this type are the Tyrny-Auz deposit in the Northern Caucasus, the Lyangar deposit in Central Asia, and the Azegur deposit in Marokko.

b. The second type of deposit, for example that found at Boshche-Kul' and Kounrad in Kazakhstan, and Agarak and Pirdouan in the Transcaucasus (Armenia), yields molybdenite as an impurity.

Geographic Distribution of Deposits in the USSR

The opening of new types of industrial deposits of molybdenum as a result of prospecting during recent years has introduced a substantial change in assessments of the economic potential of various regions of the USSR.

Thus, the deposits of the Eastern Transbaykal and the neighboring regions of Chita Oblast and Primorskiy Kray, which during the years of the First Five-Year Plan were the sole sources of molybdenum, now have secondary significance in the balance of supply. The chief industrial types of mineralization here are the quartz-molybdenum vein deposits, for example, at Gutaysk and the Umal'ta on the headwaters of the Burei River (Far East).(1)

One of the greatest achievements of geological prospecting work of the Second Five-Year Plan was the discovery and investigation of the Tyrny-Auz molybdenum-tungsten deposit in the Northern Caucasus. As a result of intensive geological investigation, the known reserves in the deposit have been increased more and more each year, and now constitute one of the most important molybdenum-tungsten deposits of the USSR.(2) As a source of molybdenum, this deposit is among the largest in the world. However, the prospects of the Caucasus are not confined to the Tyrny-Auz deposit alone. The Agarak and Pirdoudan (Transcaucasus) copper deposits of the secondary quartz type contain molybdenum, and show promise of becoming one of the chief sources for the extraction of this metal.

As another source of prospective supplies, Kazakh SSR runs the Northern Caucasus a close second. Very large copper deposits of the secondary quartz type containing molybdenum (Kounrad and Boshche-Kul'), the exploitation of which makes possible the side-extraction of molybdenum, are located here.

For some time past large deposits in the form of a molybdenite-quartz vein have been exploited in the region of Eastern Kounrad (Kazakhstan).(1)

Great prospects in regard to molybdenum and tungsten are also in evidence in the southeastern part of the Altay Kray and in parts of the Oyrot ASSR adjacent to it, i.e., the Chindagatuy deposit (Eastern Kazakhstan Oblast).(2)

Still other sources of molybdenum are the copper mines of Dzhida, Khatoma, and Davenda (Transbaykal).(3)

Description of the Deposits

1. The Tyrny-Auz molybdenum-tungsten deposit is a basic industrial item in the Tyrny-Auz ore-bearing region, where in addition deposits of tin, antimony, and other metals occur. So far as molybdenum is concerned, it is one of the largest producers in the world. The region is situated in the Northern Caucasus in the Kabarda-Balkar ASSR in the mountainous area on the left side of the Baksan River gorge and is connected with the Nal'chik highway, which passes through the gorge to the foot of the El'brus. The absolute height here reaches 3,600 meters, but the relative height (over the Baksan River channel) is 2,300 meters.

The geological structure of the whole ore field is described as follows: The very large, old rocks are pre-Cambric and their outcroppings, pre-Cambrian granite and granodiorite. Rocks bound the ore-bearing region on the north and on the south. Between the rocks lies a stratum of paleozoic sedimentary rock, which is carbonaceous and in part Devonian and Permian. It consists of clayey slate, sandstone, tuff, conglomerate, and marble, and is divided into four formations: the Tyrny-Auz, northern, central, and marble formations. Igneous rocks of the same age (trondemite, peridotite, and quartz porphyry) are present in smaller quantities.

The lower Jurassic deposit -- clayey slate and sandstone of the Makulan formations -- is of lesser importance in comparison with the carbonaceous rocks.

The entire stratum of sedimentary rock is interspersed with a variety of rock complexes of granite magma, which contain porphyritic granite (the El'-dzhurtinsk Massif), granite-porphyry, granite-aplite, labradorite-aplite, liparite, and vitrophyre.

In its structural relation the region represents a zone of breaks, with a northwesterly trend 5 kilometers in width, within the limits of which are located all the ore deposits.

The molybdenum-tungsten mineralization is situated in the central part of the ore region. Under the influence of the El'dzhurtinsk Granite Massif here, all the rock is subjected to an intensive metamorphosis, resulting in the formation of skarns in the marble and in the transformation of the clayey slate and the tuff into pyroxenic chert. A very considerable growth of skarns is noted on the watershed of the Tyrny-Auz Range, where they form the main body of ore. The ore body has a horseshoe-shaped form in the plan, is anticlinal in profile, and has the structure of a typical skarn complex, consisting of granite, pyroxene, vesuvianite, wollastonite, quartz, fluorite, pyrite, pyrrhotine, chalcopyrite, magnetite, zinc blende, and so on. Included in the composition of the skarn are several quantities of scheelite. The complex form of the main ore lode depends upon the configuration of the structural contact between the marble and the clayey shale, which acts as a feeder for the emanation of the granite magma.

Considerably later, after the formation of the labradorite-aplite, which concludes the volcanic process, in the skarn zone, apparently along the same structural seam, together with the quartz almost the total amount of molybdenite and the basic mass of scheelite was formed. In the fissured skarns a large quantity of small quartz veins and pockets filled with the above-mentioned minerals were formed sometimes together with chalcopyrite. Thus, the whole skarn is an ore mass.

Because of intensive erosion the processes of secondary change have been very slight. Of the secondary minerals molybdenum, ocher, and powellite are present.

Besides the basic type of molybdenum-tungsten mineralization, which is subordinate to skarn, there are known ore lodes of other form and composition in the region. Thus, to the northwest of the Tyrny-Auz deposit, there is a quartz vein with molybdenite. In addition, an impregnation of molybdenite has developed in a block of granite-porphyr, breaking the skarn zone.

The prospecting work being carried on at present [1947] on the deposit has penetrated to a depth of several hundred meters from the summit of the range, which indicates the extraordinary power of the ore-development process.

2. The Gutay (Chikoy) deposit is a typical example of quartzmolybdenum mineralization. It is situated within the boundaries of the Buryat-Mongol ASSR on the right bank of the Chikoy River. The Chikoy flows into the Selenga River.

The region in which the deposit is located has been built up from a metamorphic stratum of the pre-Cambrian era consisting of gneiss and amphibole. To the north and east the metamorphic stratum is changed by the intrusion of granite. In a southeasterly direction the gneiss and the amphibole are overlapped by a paleozoic sedimentary stratum.

The deposit has been described as a system of similarly oriented veins running in a north-northeast direction dipping to the east at an angle of 35-50 degrees, and of inferior metamorphic strata. The ore veins have an insignificant width of 2 to 30 centimeters.

The mineralogical composition of the deposit is described as quartz, calcite, and molybdenite. On the lower levels the deposit contains small quantities of pyrite and bismuthinite. Molybdenite is usually arranged in streaks and cut by pockets along the selvage of the veins, but the quartz and the calcite make up the internal part of the vein. The trace of the vein along the dip shows that the most intensive mineralization has adapted itself to the gneiss and the amphibolite. Thus the drift, proceeding at a height of 120 meters above the level of the river, opens veins with rich mineralization. In the transition to granite the veins show a much lower content of molybdenum and they finally play out. The change of the wall rock is described as a slight pyritization. The genetic quartz-molybdenum mineralization is combined with granite which has broken through the metamorphic stratum.(1)

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