

Salt formation in Ukraine: geology, reserves, exploitation and storage projects

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UKRAINIAN SALT FORMATIONS

In the Ukraine there are eight salt formations with ages ranging from Devonian to Neogene. On accessible depth salt formations are located in: the Transcarpathian depression as salt domes (diapirs), in the Neardobroudgea foredeep as bedded deposits, in the Dnipro-Donetsk depression and north-western Donbass as bedded and salt dome forms, in the Neacarthian foredeep as intensively fragmented bed lenses-like bodies. The Devonian (Upper Franian and Lower Famennian) formations, the Nikitovska and Slavjansk suites of lower Permian in the Donetsk depression and north western Donbass, the Neogene formations in the Transcarpathian depression, the Badenian formation in the Neacarthian foredeep and the Jurassic formation in the Neardobroudgea foredeep are characterised by an almost monomineral (halite) composition. The Kramatorsk suite in the Dnipro-Donetsk depression and the north-western Donbass as well as the Prebadanian deposits of Neogene in the Neacarthian foredeep (i.e. Vorotyscha series and Balich suite) contain thick deposits of potassium-magnesium salts.

RESOURCES

Salt deposits in the listed regions are characteristically different in composition and geological conditions. The salt reserves in Ukraine comprise sodium chloride, and potassium and magnesium salts. The major part of these reserves is connected to the evaporite basins mentioned above, the minor part to recent basins of marine origin.

ROCK SALT

The resources of rock salt include rock salt deposits, brine and native salt from the salt lakes of the Black Sea region. There are five rock salt basins in Ukraine:

- Donetsk (Donetsk region)
- Dnipro-Donetsk (the Chernigiv, Sumy, Poltava, and Kharkov regions)
- Transcarpathian (Transcarpathina region)

- Neacarthian (Lviv and Ivano-Frankivsk region)
- Neardobroudgea foredeep (Odessa region)

In the north-western Donbass (Bachmut depression) the Slavjank suite's salt beds are under exploitation. The Artemovsk, Slavjank and Novokarpaghen deposits are well known. The salt of the Artemovsk deposit is exploited by five rock salt mines, while for the Slavjank and Novokarpaghen deposits solution mining is used. The rock salt is of high quality with a low insolubles content.

In the Dnipro-Donetsk depression Upper Devonian and Lower Permian bedded deposits are situated at unsuitable depths (D – 3000 m, P 1500 – 2500 m). The Upper Devonian formation contains salt domes, of which the major part is located at depths suitable for mining. The Effremovska deposit, a salt dome structure, is exploited by solution mining.

In the Transcarpathian depression bedded salt is located at depths of more than 1500 m. The Solotvino deposit is under exploitation.

In the Neacarthian foredeep the rock salt contains a clay admixture (25 – 27 % insolubles). There are no rock salt deposits under development now.

There are three brine deposits being in exploitation - Drogobych ("v region), Dolyzna, Bolekhiv (Ivano-Frankivsk region). Brine deposits are related to Prebadanian and rarely Badenian salt formations. The host rock is represented with salt breccia being wide spread in Vorotyscha series and Upper Balich suite as well as overlapping rock horizons. Three deposits mentioned above are related to Vorotyscha series.

Salt formations in the Neardobroudgea foredeep are situated on depth - 300-500 m, with thickness of 30 to 70 m. These formation are being prospected now.

The native salt and brine in lakes of Black Sea region are mine in the Sivash, Henichesk, Sasyk-Sivash deposits.

The reserves of sodium chloride (categories A+B+CI) are 16683.892 m.t. including brine 72.283 m. t. On state balance there are 14 deposits of

sodium chloride, i.e. eight - rock salt, two - native salt-brine, three - brine, one - rock salt from sludge.

The increase of rock salt resources could be achieved in the following regions: in Bachmut depression by means of additional exploration of deposits field and prospecting of areas of SlayJansk and Nikitovka suites spread as well as rock salt horizons of Kramatorsk suite. In Dnipro-Donetsk depression the same could be achieved by including the salt domes which have been preliminary explored - the prognostic reserves of the latter are tens billions tonnes.

POTASSIUM SALT

There are three potassium salt bearing regions in Ukraine (Donetsk, Dnipro-Donetsk Nearcarpathian) but commercial reserves of potassium salts of chloride and sulphate types are connected only with Nearcarpathian foredeep molassa formations, there are two deposits being in exploitation i.e. KalushHolyn and Stebnyk-. The ores of sulphate type are comprised of three groups of rocks: kainite, langbeinite-kainite, langbeinite. Rocks of chloride type are presented by sylvinite and carnallite.

The ores are characterised by a low content of K_2O , 10-11%, and high content of insoluble minerals - 14-15%. The ore is quarried and mined.

There are perspectives for reserve increase for both of the two operating enterprises and foundation of a third enterprise.

The reserves of potassium (K20) (categories A1-B+Cl) are 250.306 m. t

In Donbass region potassium salts deposits of industrial significance were discovered in Kramatorsk suite Lower Permian, within the limits of Kramatorsk-Chasovjar syncline. These deposits have been studied by prospecting in the area 15x6 km in the depth interval 750-1200 m. Two potassium beds have been distinguished, i.e. sylvinite and sylvinite-carnallite. Reserves are as follows: for upper sylvinite bed of sylvinite horizon- 261 m.t., for

complicated bed of sylvinite-carnallite horizon - 580 m.t.

MAGNESIA SALTS

The reserves of magnesia salts are connected with salt formations of Nearcarpathian foredeep and brines of basins of Black Sea region.

The reserves of magnesia salts (MgO) (categories A+B+C₁) are 87.463 m. t. including brine - 6.832 m. t. These reserves include five deposits (two - salts of evaporate formations and three - brine).

Two deposits are under exploitation - KalushHolyn and Sivash.

In Dnipro-Donetsk depression commercial deposits of bishofite have been discovered, The bishofite layers thickness up is to 30m.

SALT FORMATIONS AS A CONSTRUCTION MEDIUM

Salt formations are regarded as underground storage and hospitals construction media.

Storage for oil and oil products exists in salt domes in Dnipro-Donetsk and Transcarpathian depressions. There are plans for construction of storage oriented on different targets (i.e. oil, oil products, gas, compressed air, chemical products etc.).

Special methodology for sites selection and selection of favourable intervals has been developed.

The project of radioactive waste disposal in salt formations has been considered as a possible (alliterative) variant in the Programme of radioactive waste management and Programme of radioactive waste deep geological disposal in Ukraine. In the course of the preparatory stage of the latter Programme realisation several sites-candidates in salt domes and reworked salt mines have been selected. The selection of sites-candidates has been carried out on the basis of the methodology specially elaborated.