Geological Exploration

Geological exploration is one of the Norilsk Nickel Group's core businesses, which ensures sustainable extraction volumes, an optimal structure of mineral reserves, and enhanced replacement of mineral resources.
The unique mineral resource base of the Taimyr and Kola Peninsulas augurs well for the Company's long-term development.

KEY GEOLOGICAL EXPLORATION OPERATIONS

Mineral prospecting

Mineral appraisal

Mineral exploration

These include:

- geological exploration within the licence blocks of the ongoing operations in the north of the Krasnoyarsk Territory and in the Murmansk Region to ensure mineral supplies for the core production sites and improve the Company's operational performance
- geological exploration in areas farther away from the key production sites to fully unlock the resource potential of the Taimyr and Kola Peninsulas
- prospecting, appraisal and exploration of highly liquid raw materials (Tier 1 assets) in high-potential regions offering Norilsk Nickel a competitive edge

Geological exploration is carried out under the Company's projects by the Group's specialist service providers based in the regions of operations

TAIMYR PENINSULA

Solid minerals

Geological exploration on the Taimyr Peninsula is aimed at replacing nickel, copper, platinum group and other mineral reserves in order to ensure the uninterrupted operation of the Group's mining facilities in the Norilsk Industrial District.

Exploration is underway at

- the Maslovskoye Field,
- deep horizons and flanks of the Oktyabrskoye and Talnakhskoye Fields,
- northern flank of the Norilsk-1 Field.

Industrial limestone is being prospected and appraised in the Verkhne-Tomulakhskaya Area of the Norilsk Industrial District.

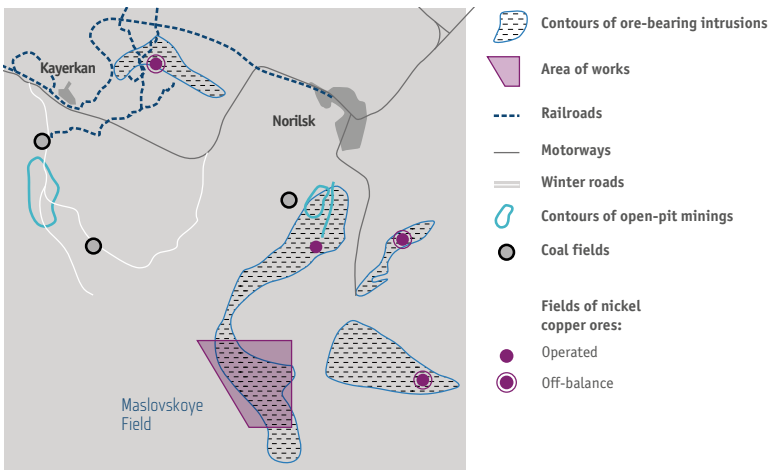
In 2015, the Company also kept prospecting for sulphide ores in Lebyazhninskaya, Razvedochnaya, Mogenskaya, Khalilskaya, Yuzhno-Khalilskaya and Nirungdinskaya Areas of the Norilsk Industrial District.

Maslovskoye Field (platinum-copper-nickel ores)

The field is located in the Norilsk Industrial District, 12 km south of the Norilsk-1 Field.

Estimated reserves of disseminated ores make it possible to classify the Maslovskoye Field as one of the largest platinum-copper-nickel fields. Areas of rich ore veins were found in the disseminated ores of the Maslovskoye Field. In 2015, the Company was granted a licence to explore and mine copper-nickel sulphide ores.

In 2014–2015, the Company undertook research to define the geotechnical, hydrogeological and mining conditions for the purposes of Maslovskoye Field development.



■ Balance reserves of Maslovskoye Field

	$C_1 + C_2$ MINERAL RESERVES	METAL CONTENT IN ORE
Ore, mt	215	
Palladium, '000 oz t	32,262	4.56 g/t
Platinum, '000 oz t	12,479	1.78 g/t
Nickel, kt	728	0.33%
Copper, kt	1,122	0.51%
Cobalt, kt	34	0.016%
Gold, '000 oz t	1,304	0.19 g/t

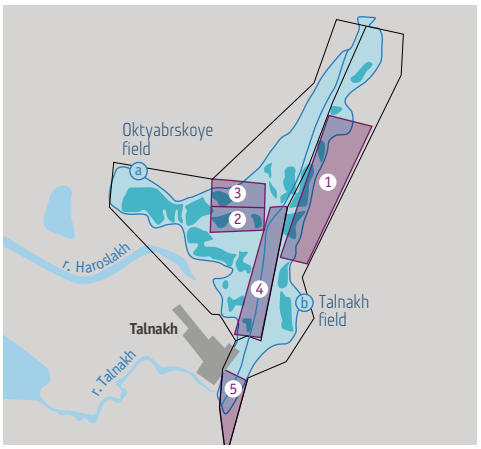
Business Overview

Flanks and deep horizons of Talnakh Ore Cluster (cuprous ores)

The Company's geological exploration focuses on the search for unregistered reserves of rich and cuprous ores at the Oktyabrskoye and Talnakhskoye fields.

Geological exploration is underway in the northern flanks of Taimyrsky Mine, eastern flanks of Skalisty Mine, southern flank of the Talnakhskoye Field, and in the Mayak Mine area. New exploration wells opened up bodies of copper-nickel sulphide ores. In 2015–2017, the nickel reserves are expected to increase by approximately 500 kt.

To extend the service life of Zapolyarny open pit at the Norilsk-1 Field, exploration specialists keep seeking to convert the underground mining reserves into reserves intended for open pit operations.



Fields boundary:
- Oktyabrskoye
- Talnaknskoe

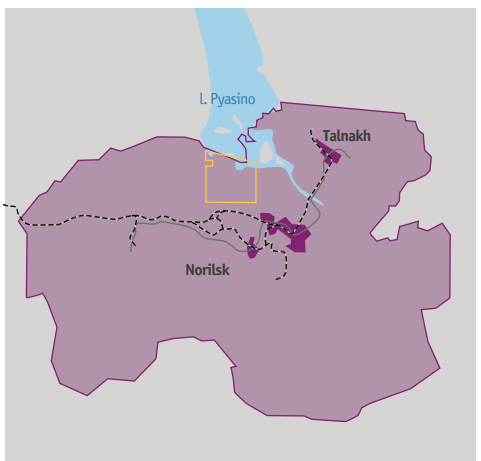
Contour of mine take:
- a Oktyabrskoye field
- b Talnakh field

Rich ores deposits

Contour of geological exploration:
1 Eastern franks of Skalisty mine
2 Franks of Severnaya 3 deposit
3 Franks of Severnaya 4 deposit
4 Southern frank of Talnakh field
5 Southern frank of Mayak mine

Prospecting and appraisal of new copper-nickel sulphide ore fields in Taimyr

In 2014, the Company obtained subsoil exploration licences to prospect for and appraise copper-nickel sulphide deposits in Lebyazhninskaya, Razvedochnaya, Mogenskaya, Khalilskaya, Nizhne-Khalilskaya and Nirungdinskaya Areas of the Taimyrsky Dolgano-Nenetsky Municipal District (Krasnoyarsk Territory). The respective prospecting and exploration projects have all been prepared. In 2015, the Company carried out geophysical and geochemical operations to identify anomalies in the areas for subsequent confirmation through drilling.



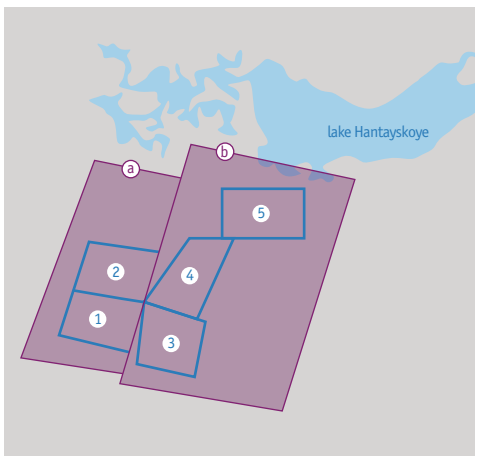
Borders of Uniform municipality of Norilsk

Area of works (99.08 m²)

Industrial and inhabited facilities

Railway

Motorways



Ore knots:
- a Kulyumbinskiy *(licenses of Norilsk Nickel)*
- b Halilskiy *(licenses of Norilskgeologiya)*

Objects of geological exploration
1 Potential area
2 Mogenskaya area
3 Nigne-halilskaya area
4 Halilskaya area
5 Nirunglinskaya area

In 2015–2017, the nickel reserves are expected to increase by

500 kt

Limestone prospecting and appraisal in Verkhne-Tomulakhskaya Area

The licence block is located in the Taimyrsky Dolgano-Nenetsky Municipal District and borders the northern part of Norilsk's Talnakh District. The central point of the Area is 10 km away from the industrial facilities of Oktyabrsky and Taimyrsky Mines.

The Company appraised the area, developed exploration conditions and prepared a report. Estimated limestone pit reserves total approximately 57.3 mt. In 2015, relevant reserve estimates were submitted to the State Committee for Reserves (GKZ).

Natural gas reserves as at 1 January 2016

295.7 bn cu m

Estimated limestone pit reserves in Verkhne-Tomulakhskaya Area

57.3 mt

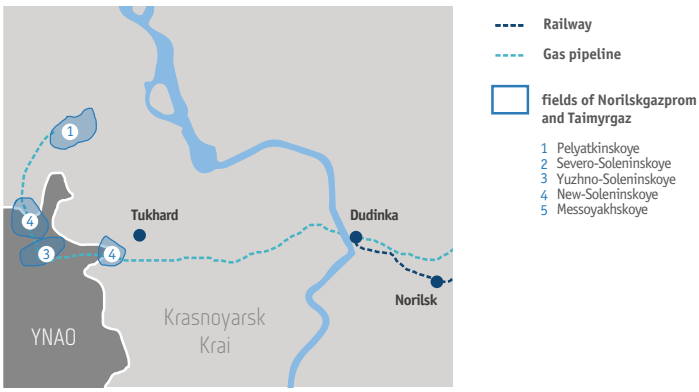
Natural Gas and Gas Condensate

Norilskgazprom

In 2015, 3D CDP seismic fieldwork was conducted across 320 sq m of the Severo-Soleninskoye, Yuzhno-Soleninskoye and Messoyakhskoye license blocks to obtain detailed information about deposit geology. The company also completed the design of one appraisal and four exploration wells.

Taimyrgaz

The company completed the design work and launched the construction of an appraisal well in the northeastern flank of the Pelyatkinskoye Field.



■ Natural gas and gas condensate reserves at the fields of Norilskgazprom and Taimyrgaz as at 1 January 2016

FIELD	RESIDUAL HYDROCARBON RESERVES WITHIN LICENCE BLOCKS (CATEGORIES A+B+C_1)	
	FREE GAS, BN CU M	RECOVERABLE CONDENSATE, MT
Norilskgazprom		
Messoyakhskoye Gas Field	6.9	–
Yuzhno-Soleninskoye Gas Condensate Field	53.1	0.5
Severo-Soleninskoye Gas Condensate Field	45.5	0.5
Taimyrgaz		
Pelyatkinskoye Gas Condensate Field	190.2	7.1
TOTAL RESIDUAL RESERVES	**295.7**	**8.1**

Business Overview

KOLA PENINSULA

In 2015, Allarechenskaya Area was the only geological exploration site on the Kola Peninsula.

■ Balance reserves of Vuruchuayvench Field

	$C_1 + C_2$ MINERAL RESERVES
Ore, mt	83.6
Nickel, kt	248.2
Copper, kt	164.9
Cobalt, kt	10.9
Platinum, '000 oz t	569
Palladium, '000 oz t	2,781
Gold, '000 oz t	144

Allarechenskaya Area

In 2010–2014, the Company completed geological and geophysical ground surveys and implemented the required drilling to verify data about the mixed anomalies identified during airborne geophysical operations, and geochemical and geophysical ground surveys of 2007–2009. The new wells identified over 10 intrusive hyper-basic massifs containing Pechenga copper-nickel ore bodies with commercial nickel content.

In 2015, the prospecting and appraisal results were summarised in a relevant work completion report. The report was reviewed by the R&D Panel of the Northwestern Federal District's Subsoil Use Department (Sevzapnedra) in the Murmansk Region and archived at the Russian Federal Geological Fund and Local Fund of Geological Information in the Northwestern Federal District.

Vuruchuayvench Field

Vuruchuayvench Field of platinum group ores is located in the central part of the Kola Peninsula, in Murmansk Region, 10 km away from Monchegorsk and 5 km away from the industrial site of the Severonickel Plant owned by Kola MMC.

In 2008, a geological exercise that started back in 2004 identified a deposit of platinum group ores. Upon the discovery, the Company applied for the relevant exploration and mining licence.

In 2013, the Company completed a feasibility study for provisional mining parameters with a mineral reserves estimation covering the entire field. The reserves estimates were reviewed by the government and entered into the Company's books.

Balance reserves of ore of Vuruchuayvench Field

83.6 mt

CHITA PROJECT (TRANS-BAIKAL TERRITORY)

In 2015, due to the unfavourable economic environment, the Company decided to renounce its subsoil use rights for the following sites:

- Lugokanskaya Area;
- Kultuminskoye Field (copper-iron-gold ores);
- Serebryanoye Field (gold and silver ores);
- Zergunskoye Field (gold ores, Sretenskaya Area).

In 2014, due to the low international molybdenum prices, the subsoil user suspended its right to develop the Bugdainskoye Field for three years.

Bystrinskoye Field

Bystrinskoye Field is located in the Gazimuro-Zavodsky District of Trans-Baikal Territory. The closest residential areas are Novoshirokinsky, 14 km north-east of the field, and Gazimursky Zavod, a district centre 25 km to the north-west.

In 2015, to increase the volume of development-ready reserves on the flanks and deep horizons of the field, the Company launched a follow-up exploration exercise. Drilling showed that the commercial mineralisation extended into both flanks of the explored areas and deep horizons. The field exploration is set to continue in 2016.

■ $B + C_1 + C_2$ mineral reserves at Bugdainskoye Field

	MINERAL RESERVES
Ore, mt	812
Molybdenum, kt	600
Gold , '000 oz t	360
Silver, '000 oz t	6,221
Lead, kt	41

Bystrinsko-Shirinskoye Gold Field

Bystrinsko-Shirinskoye Gold Field is located in the Gazimuro-Zavodsky District of Trans-Baikal Territory, 24 km south-east of Gazimursky Zavod. The Bystrinsko-Shirinskoye licence block is adjacent to the Bystrinskoye Field. Flank exploration resulted in the extension of the field's boundaries. Apart from gold ore bodies, the field's western flank was found to contain porphyry copper mineralisations. The Company appraised the P_1 prognostic resources estimating the expected increase in reserves at 1,929 thousand oz t for gold, 262 kt for copper and 3,033 thousand oz t for silver.

In 2014–2015, the Company launched a locally administered pilot mining project using in-situ chlorination. The preliminary results proved this technology to be viable for the Bystrinsko-Shirinskoye Field.

Prospecting in new potential areas

Tsentralno-Shakhtaminskaya and Zapadno-Shakhtaminskaya Areas

In 2015, the Company obtained a subsoil exploration licence to prospect for and appraise deposits of copper, gold, iron and associated minerals in Tsentralno-Shakhtaminskaya and Zapadno-Shakhtaminskaya Areas.

These areas are located in the south-eastern part of Trans-Baikal Territory, 22 km away from the Borzya – Gazimursky Zavod railway, and span the Alexandrovo-Zavodsky, Shelopuginsky and Gazimuro-Zavodsky Districts. The licence block is located in immediate proximity to the well-developed infrastructure of the former Shakhtaminsky mine, with the settlement of Vershino-Shakhtaminsky sitting right in the middle of the area.

The subsoil exploration project was reviewed by the government in 2015 and is now at the prospecting stage.

Chingitayskaya Area

In 2015, the Company obtained a subsoil exploration licence to prospect for and appraise deposits of copper, gold, molybdenum and associated minerals in Chingitayskaya Area. The area is located in the Alexandrovo-Zavodsky District of Trans-Baikal Territory, 25 km north-west of the district centre. Near the licence block, some 3 km to the south, there is a Borzya – Alexandrovsky Zavod asphalt road (managed by the territorial government) and the Borzya – Gazimursky Zavod railway. The subsoil exploration project was reviewed by the government in 2015 and is now at the prospecting stage.

Honeymoon Well Development Project

In 2015, geological exploration under the Company's Australia licences focused on the Honeymoon Well Nickel Project (Wedgetail, Hannibals, Harrier, Corella and Harakka fields) and prospective Albion Downs North and Albion Downs South Areas. Geological exploration of the Honeymoon Well sought to confirm the accuracy of prognostic resources split up into the Indicated and Inferred categories pursuant to JORC 2012. The Company also completed a drilling programme to verify data about a prospective electromagnetic anomaly in the deep flanks of the Wedgetail Field. To further assess the potential of Albion Downs North Area, the Company launched desktop studies aimed at reinterpreting the existing geological data. Albion Downs South Area, on the other hand, saw a minor confirmatory drilling programme (1,102 running metres deep).