

Series

A visit to Mirny

The first thing which came to my attention when I looked out of the small window of the Alrosa air plane was an enormous crater, the famous „big hole“ of Mirny. The crater is spiralling down to a depth that is hardly visible from above, and I learn later that it is in the range of 525 meters. The „big hole“ is what remained of the Mir pipe, the first kimberlite pipe that was worked for diamonds in Yakutia, from 1957 till 2004. It is one of the largest pipes, both in Russia and worldwide.

Von Elisabeth Strack

The view from the top is even more impressive than I had expected from photographs. There is a striking resemblance with the other „big hole“, the one from Kimberley in South Africa. The city of Kimberley, named itself after a British governor at the time of the diamond discoveries in the last quarter of the 19th century, has later given its name to the diamond-containing rock within the pipes: kimberlite.

The airplane is filled up to the last seat. When we approach Mirny, all passengers are suddenly awake, forgetting about the narrow seating conditions and trying to catch a glimpse of the famous sight. After a few seconds, the sight is over, and the plane is preparing to land at Mirny airport which is situated about 4 kilometers east of the city centre. The airport operates 24 hours a day and is used not only by Alrosa's own airline, Alrosa Mirny Air Enterprise, but a few other small local airlines. Besides, it is a designated emergency airfield for the cross-polar route between North America and Asia.

The Mir pipe

Still sleepy after a seven hours' night flight from Moscow, I miss the unique opportunity to take a photograph of the „big hole“ from above. I can only hope that another opportunity will present itself later. A newspaper article comes to my mind which mentioned that the airzone above the pipe is closed for helicopters as there is the danger that they get „sucked in“ by an downward airflow. I conclude that from the sheer size of the „big hole“ this seems understandable.

Two days later I have indeed an opportunity to take photographs of the Mir pipe. Our group is driven to the pipe, which is situated just outside of Mirny, and from the loftily constructed viewing-platform, secured in the ground by thick steel cables, we are allowed to take a glimpse over the edge into the depth of the crater (Abb. 1, 2, 3).

The Mir pipe was the first diamond pipe worked in the USSR, discovered on June 13, 1955 by Yuri Khabardin,

Ekaterina Elagina and Vladimir Avdeenko during the long Amakinskaya expedition to what was then the Yakut ASSR. At that time, the Sowjet Union was in urgent need of industrial diamonds for its growing steel industry and had made a decision to prospect



Abb. 1 + 2: Mir pipe (big hole)

for diamonds in the region of the Siberian platform in its Far East where kimberlite pipes with diamonds were suspected to occur.

Kimberlite pipes are volcanic pipes of a conical to cylindrical shape, formed within 1.5 - 2 kilometres of the surface when highly pressured magma from very deep mantle-derived sources (150 to 450 km in depth) explodes upwards. The depth of melting makes kimberlit, an ultramafic igneous rock, prone to hosting diamond xenocrysts. It contains a number of other minerals, as pyrop, peridot, yellow zircon and chrome diopside. They are seen as indicator minerals for the presence of diamonds. In Yakutia, the minerals are mined together with diamonds.

The pipes can reach a diameter of a few hundred metres to one kilometre and more at the surface. They were formed 70 to 150 million years ago. Towards the surface, the kimberlite rock suffers alteration and turns by serpentinization into a bluish looking rock, named blue ground. Even further to the surface, the colour changes by weathering to yellow (yellow ground).

The name „Mir“ which was chosen for the pipe means as much as „peace“ in Russian language. A second meaning is „world“. The words of the telegram which was sent by the expedition members to Moscow have later become famous in Russia: „Lit the peace pipe: tobacco is excellent“. They announced the beginning of a multi-million-dollar diamond industry.

Two years later, the Mir pipe was to become the first diamond pipe worked in the USSR, after a government commission had decided in 1956 to start exploitation because first trials had delivered diamonds of high grade.

Operation of the Mir pipe started in 1957. In March 1957, the first processing plant, called plant No. 1, was brought in a dismantled state from the diamond workings in the northern Ural mountains, it was installed within a few months by the combined efforts of all those working in Mirny. Plant No. 2 followed in July 1958 and plant No. 4 in September 1958. Plant No. 3 was established in 1966. By the year 1977, the hole had a depth of 23.5 metres.

In 2001, open pit mining was stopped and workings were finally closed down on April 30, 2004. About 165 million cubic metres of rock have been removed since operations began in 1957. At the time of closing the pipe had a surface diameter of 1250 metres and a depth of 525 metres. At the bottom, the diameter was in the range of 310 metres. The length of the spiral road winding down the crater is about 7.7 kilometres. The pipe had been worked by excavators who loaded the rock on Belaz trucks which delivered it to the plants. There was no blasting involved. Preparatory works for future underground mining have already begun as the actual depth of the pipe is about 1200 metres. There are also plans for reworking the old tailings of the first decades again at the Mirny plants.

The history of Mirny

A beautiful sunny day with a nice fresh breeze is awaiting us outside when we leave the airplane. It is difficult to imagine that temperatures can go down to minus 60 degrees Celsius in winter. They are also reported to go as high as 40 degrees Celsius in summer, we consider ourselves lucky that this is apparently not yet the case in early July 2007. There are also no mosquitos, contrary to many predictions, but instead we shall have the pleasure of observing



Abb. 3: Platform on top of the Mir pipe

that nights do not really get dark, as we are not too far from the polar circle (only about 450 kilometres away).

The small airport is the only gate to the outside world. There are no trains going to and from Mirny, and access by car is confined to a few roads leading only to places in the immediate outskirts. The dirt road to the Internationalnaya mine, situated 17 kilometers from Mirny, is an example for such a road, we shall use it the next day for our visit of the underground mining operation. Transport by land is easier on snow roads in winter.

When we leave the airport, we get the first view of the city – it seems to be hidden behind a scenery of factory buildings. They are processing plants, as we shall learn later. There is something in the air which I cannot exactly describe but which I would identify as the smell of the north or the atmosphere of an isolated place somewhere in the north, resembling an alpine resort. We are indeed finding ourselves at a very isolated place, about 800 kilometers north of Lake Baikal and 820 kilometers west of Yakutsk, the state capital. There are no mountains, however. The city has a small river, the Irelyakh, which forms part of the basin of Vilyuy river. We will cross Irelyakh river a few times during the next two days.

Most passengers who came with us from Moscow are probably returning to Mirny where they normally live, they have their families waiting for them at the airport. There are usually no tourists and it needs a special permit to visit the town. Our small group of seven people from five different countries, accompanied by two Russian guides, came as participants of a pre-conference trip to the International Gemmological Conference which takes place in Moscow this year. During the next two days, we will have the possibility to get an impression of the Yakutian diamond industry.

It is about 10 o'clock in the morning when a bus brings us to the Zarnitza hotel in the centre of town. Zarnitza means as much as „summer lightning“ in Russian language, the name was given to the first kimberlite pipe discovered in Yakutia by Larissa Popugajewa in 1954. She was a geologist from St. Petersburg who later became the „victim of her own discovery“ as the director of the Mirny city museum will tell us two days later, explaining us the tragic fate of the woman who contributed with her discovery to the history of diamonds but was not appreciated in her own time.

The beginnings of Mirny are closely or rather solely related with the already-mentioned discovery of the Mir pipe in June 1955. In late July 1955, members of the expedition founded the first settlement on the banks of Irelyakh river, in the direct vicinity of the pipe. At that time, the vast territory of western Yakutia was practically uninhabited, there were no roads and no navigable rivers. In order to develop the diamond industry, it became necessary to attract people from all over Russia who were willing to master this severe part of the country. Those who came were mainly young peo-

ple directed by the Komsomol organization, and among them were veterans of World War II who were eager to start a new life. The first settlers lived in tents, heated by big iron stoves, as there were no houses.

In March 1957, construction of the city started according to a general plan, the first step of which was cutting of the surrounding woods in order to clear the territory for the future town. The first streets were being built with felled trees and they were named Moskovskaya Street and Leningradsky Avenue, in honour of the young pioneers coming from Moscow and Leningrad (today St. Petersburg). Victor L. Tikhonov was the first manager, leading all works of civil and industrial construction. A street in Mirny is today named after him.

The first loads of necessary supplies came along the Lena River and via the town of Mukhtuya (today called Lensk), 240 kilometers to the south of Mirny and the nearest settlement of any size. The trucks could drive the supplies to Mirny only on snow roads in winter, as there was no other road.

The first one-storey wooden houses were already built in 1955, followed in 1957 by two-storey stone houses built on concrete piles. Today many houses have 9 or 10 storeys. The town looks clean and well organized, with streets arranged in a rectangular pattern. Huge posters, reminding of the high days of Soviet propaganda, cover some of the walls of the larger buildings, showing elderly men in their suits, possibly politicians or leading managers of the Alrosa company who is the main employer in town. I observe young couples with their children on a playground near the hotel, where colourful constructions invite the children for climbing. The few pedestrians walking

around in the streets seem to make no noise, everything is quiet, there is however some traffic in the streets. Life seems to follow a certain pattern that was once predominant all over the Soviet Union.

The nineteen fifties saw a swift progress. In 1959 there were already 5000 inhabitants. From 1960 onwards, the small electric motors in the open pit, the industrial zone and the settlement were replaced by an electric power transmission line from Lensk. Between 1960 and 1967 the Vilyuyskaya hydropower station was constructed, it was the first station on Permafrost.

The pioneers of Mirny surmounted incredible difficulties, and it is their hard work which explains the extraordinary development of the city within only 50 years from an isolated and deserted spot in the taiga to a modern industrial town. Today, the people of Mirny are proud on the efforts of their fathers and grandfathers. When I walk the streets around the hotel the next day, I discover name plates on quite a few houses which indicate that a hero of socialist labour has lived in them. Distinctions and honours of this type were a means of the government to appreciate the achievements of those helping to create an extraordinary new place.

The pioneers are also honoured with a monument in the municipal park, built by the architect Evgenij Ermolaev in October 1970. It shows an obelisk, 24 meters high, with a diamond crystal and is surrounded by a mosaic panel showing the heroic labour efforts of the people and the riches of the land. There is another monument on Victory square, commemorating the 30th anniversary of the Great Patriotic War in 1975 and dedicated to the veterans and



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victims. A further monument is dedicated to the discovery of diamonds by Soviet geologists, and shows a man and a woman geologist led by a

local Yakutian guide on their way through the wilderness (Abb. 4).

The main square in the city center is named Lenin square after the monument of Lenin which stands there.

The square is flanked by the local administration building on the right and hotel Zarnitsa on the left side, and it is faced by the Cultural Palace „Almaz“ (diamond), built in 1978. It houses a cinema, a theatre and changing art exhibitions. From time to time performing artists are flown in from Moscow. On Lenin square the annual „Day of the City and the Diamond Mining Industry“ is celebrated. Mirny has an active cultural life today, and there are secondary schools and a polytechnical institute, plus a modern poly-clinic and sport stadions.

Our city tour brings us later to the rather impressive, modern stadium and sports centre. The whole complex is sponsored by the Alrosa company. We climb up to the highest seats of the stadi-

on from where we can have a glimpse of the great open pit of the Mir pipe (Abb. 5).

The city of Mirny has about 40.000 inhabitants today. In January 2000 it received the first orthodox church, opened by the Archbishop of Yakutsk and Lensk and named the Holy Trinity Temple.

While our bus driver gives us a tour of Mirny, I have a good opportunity to ask questions to Nicola, the interpreter who accompanies us. I learn that most people living in Mirny cherish their way of life. Salaries are good and include a premium. Prices are however also relatively high as all goods have to be brought in by air plane. The population is mainly Russian, as is the management of the Alrosa company. This does, at least on the surface, not seem to represent a problem to the local Yakutians who apparently accept that the leading role of the diamond industry in their own, native country is played by a predominantly Russian company, as long as they have secure jobs in that industry.

A visit to the Alrosa headquarter

After our arrival at the Zarnitsa hotel we decide that the famous diamond town of the far east is such a unique place that we should start visiting immediately. We sit down together in the hotel restaurant to take a quick breakfast but get instead acquainted with what people might call „the old system“: the waitresses seem to be reluctant to take our orders and make us adhere strictly to the existing kitchen plan.

The head office of the Alrosa company, which we want to visit first, is only two blocks away, on the corner of Lenin street. It is an impressive modern building, surrounded by a small alley of birch trees (Abb. 6). The inside is as beautiful as the outside. The entrance hall is large and spacious and has a few showcases with exhibitions of diamond-related topics. An enormous hour glass, made of Siberian nephrite and containing diamond dust, is presented in a show case. I have a similar but much smaller one in my office in Ham-

burg which a Russian friend presented to me in 2004.

We are directed to the second floor where we shall meet the vice-president and some of the managers who are responsible for operations of exploration and production. The conference room is modern and has the latest equipment. It is obvious that we are in the headquarter of a wealthy company, the office could be situated anywhere in the world. But it is situated in the middle of nowhere in northeastern Siberia.

We are allowed to ask questions which Nicola, who accompanies us wherever we go, translates. Questions concentrate on production figures and the role of Alrosa on the Russian and the world market. The Alrosa company is working several mining complexes which are directed by subsidiary companies, named Mirninskii, Aikhal-skii, Udaschinski, Nyurbinskii and Anabarskii GOK.

We learn that the answers to most of our other questions will become evident later when we will actually be explained and will be able to see with our own eyes what we were asking for: the type of mining and processing employed, sorting and quality criteria. The next two days are devoted to those topics.

The Alrosa company

The Alrosa company exists only since 1992. The full name is Almazly Rossii-Sakha Joint Stock Company, it was set up by a presidential decree in February 1992. The name was shortened to Alrosa in 1998. The company is engaged in the exploration, mining, manufacture and sale of diamonds, it's aim is to establish Russia as a primary global player on the diamond market.



Abb. 4: Monument for the geologist-discoverers



Abb 5: The stadion



Abb. 6: Alrosa building in Mirny

In December 2006 the Russian Federation held 50 per cent of Alrosa, the Republic of Sakha (Yakutia) 32 per cent, while 8 per cent were held by local communes of regions in Yakutia where diamonds are found, 5 per cent by the fund of social warranties to servicemen in the Russian Federal government and 23 per cent by employes of organizations of the diamond complex. The supervising council consists of 15 persons. Alexeji Kudrin, Russian Federation Finance Minister, was elected chairman on August 2, 2007.

In 2005, diamonds worth 2.8 billion US dollars were produced, with a net profit of 400 million dollars. The company has sufficient diamond reserves to maintain production at the current level for the next 50 years. It has recently started mining operations in the northwestern Archangelsk region of Russia and in Angola.

The predecessor of Alrosa was the Yakutalmaz trust, incorporated in January 1957, after Nikita Chruschtschow had announced the discovery of diamonds at the 20th Communist Party Congress in 1956. Yakutalmaz sold the first 13.000 carats of rough diamonds in 1959 to the De Beers company, they had been delivered by the plant No. 1 in Mirny in June 1957.

While Yakutalmaz was responsible for diamond ex-

traction sorting was done at the Gokhran company (who also stored reserve quantities of diamonds), a division of the Ministry of Finance. Almazjuwelir-export was responsible for marketing.

Alrosa started operations in early 1993 and has since successfully reached independence from Moscow who before had wanted to gain more control of the Republic of Sakha. Alrosa has used its monopoly from 1999 onwards, expanding activities in production, cutting and marketing. Investment in exploration led to the discovery of the Botuobinskaya Pipe in March 1994 and the Nyurbinskaya Pipe in 1996, both in the new kimberlite field of Nakynskoye east of Mirny. In the year 2000 the subsidiary Brillanty Alrosa was founded for diamond cutting and polishing, with offices in Moscow, London, Antwerp and Israel.

Alrosa is meanwhile selling half of its production inside of Russia, where a number of privately-owned cutting plants have spread up besides of the government companies. The remaining half can be sold to foreign buyers as there are no longer export regulations for diamonds. The relationship with De Beers, for a long time the number one buyer, had been under investigation by the European Court lately for violating anti-trust regulations and De Beers had originally said that it would limit the

quantities bought from Alrosa during the next three years. Meanwhile, Alrosa is free to sell to whatever companies in whatever countries and can even conclude sales in foreign sales offices. The total production is planned to reach a value of 3 billion US dollars in 2010.

Alrosa organizes, together with the Diamond Chamber of Russia, regular auctions. On August 1, 2007 the auction was for the first time open to foreigners, it was an auction for special sizes of rough diamonds, of between 10.80 to 50 carats.

A visit to the Internationalnaya diamond mine

On the second day of our visit we drive about 17 kilometers north of Mirny in order to visit the Internationalnaya pipe which is operated as an underground mine. The dirt road to the mine is surrounded by the characteristic forest of the taiga, mainly made up of spruces and larches (Abb. 7). There are a few open spaces where trees have been cut.

The Internationalnaya pipe was discovered in 1969 but resumed operations only in August 1999. Reserves are estimated to last for the next 25 to 30 years, and the pipe is considered as one of the three best diamond mines in the world.

It is the only underground mine, construction started in

Abb. 7: The road to Internationalnaya and Intern. Building



1976 and was achieved with help from the countries leading institutes. There are two shafts with a depth of 1060 and 2040 metres respectively, connected by horizontal corridors that are spiralling down.

After arrival we are at first made to watch a film with security instructions before we are asked to change into a type of overall. We are handed out a security helm with a lamp and are instructed how to use it. We get gloves in order to protect our hands when we are down in the mine. When our outfit is finished, we join a group of Yakutian mining students for going down with a large type of hoisting machine (Abb. 8).



Abb 8: On the way down into the Internationalnaya mine

We get out at a depth of about 700 metres and are eager to start our walking tour of nearly one kilometre in the complete



Abb. 9: Trucks driving the mining load to a processing plant

darkness, only lit by the tiny lamps on our helms. The young guide brings us to several interesting viewing points at different levels while we walk around in an oval circle that leads us even further down. We are able to see walls with kimberlite rock and we can recognize smaller horizontal kimberlite dykes. We encounter miners at work with special machinery used for the extraction of the diamondiferous rock and we walk around trucks. We do, of course, not see a single diamond but we are able to get an overall impression of the organization of an underground diamond mine and we can see with our own eyes to what hardships and technical achievements men are willing to go through for recovering the most splendid of gemstones. I manage to talk a few sentences with a young miner and he allows me to pick up a piece of salt, an accompanying mineral in the pipe.

Before we drive the country road back to Mirny we have a look at the open pit working of the Internationalnaya mine which is situated nearby. It is already worked to a depth of 286 meters but is temporarily closed as underground mining is envisaged for the future. The depth of proven reserves goes to 1220 meters.

The Processing Plant No. 3

We do not eat lunch at the cafeteria of the Internationalnaya mine which might have given us more of an insight into the working life of diamond miners, instead we go back to our hotel. The afternoon is dedicated to the visit of the processing plant No. 3 in Mirny. We are curious to see what methods are used for separating diamonds out of the kimberlite rock.

The loads of kimberlite ground are brought in by trucks (Abb. 9). Material from the pipes

goes at first to a mill where it is crushed into smaller pieces while material from alluvial deposits goes directly to the conveyor belts which lead to the washing plants. Before we are allowed to enter, we go through a strict security control. We have to promise not to use our cameras and only one person from our group is allowed to take photos. We are asked not to use these photos for publication.

The plant is housed in a huge building which is divided into several departments, according to the different methods used. The whole operation is supervised with modern computer surveillance technology. There are washing plants where the run of the mine is washed out to increasingly smaller sizes. For the final separation grease belts are used but the concentrate is also transported to x-ray fluorescent separators which identify diamonds by their x-ray fluorescence and screen them into special holes, thus separating them from the surrounding pebbles.

For the separation of very small diamonds foam separation is used.

The Diamond Sorting Office

On the third day we have the opportunity to visit the central sorting office of the Alrosa company. We cannot actually see how the sorting is done, as visitors – due to security reasons - are not allowed into the work rooms. We are presented, however, with a CVD which explains the sorting procedure.

The Diamond Sorting Centre (DSC) was established on November 27, 1990 with the help of the former research institute Yakutniiproalmaz. The work of the Centre consists of:

1. Classification of raw diamonds according to the different origins.

2. Sorting and expert evaluation according to size, shape, colour and clarity.

Sorting for size is done by screens, and sizes of above 3.5mm are separated by weight, divided into 16 weight groups.

Shapes differ for different mines. Octahedrons with combinations of other crystal faces are apparently typical for both the Mir and Jubilee pipes while in pipes further to the north more rounded shapes appear. The International mine delivers sharply-edged octahedrons and macles. Udachnaja delivers octahedrons and macles and diamonds are generally rather smaller.

Diamonds from the relatively new Nyurbinski complex have often a frosted appearance and a green coating under which the crystals may be colourless. The Aikal mining complex delivers generally large crystals and usually at least 10 large crystals are found per year.

Colours also differ for different mines, the Udachnayamine has a certain percentage of brown colours and grey, opaque diamonds.

Dodecahedrons, often with distorted surfaces, are characteristic for the Anabarski placer mining complex. It delivers pink and red and other colours.

Classification results in 7500 categories. The sorters receive their training at the Gemmological Centre of the Geological Prospecting Academy in Moscow.

3. Constant investigation of mineralogical and physical features of diamonds from new deposits and prospected areas and establishing of databases for comparison with already existing deposits.

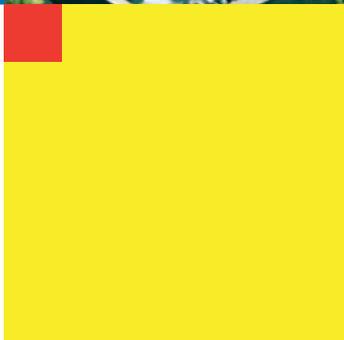
The Sorting Centre keeps a complete collection of diamonds, connected with the history of geological exploration work for the discovery of kimberlite pipes in Yakutia.

We are allowed to view the sorted production of several places of origin, all crystals spread out on a huge table showcase. There is a number of extraordinary large crystals among them. This resembles of being led into the interior of a treasury and represents a rare and unique opportunity. At this point, we are allowed to take photographs (Abb. 10-16).



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Abb. 10: Diamond crystal in kimberlite

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Abb. 11: Diamond crystals from the Udachnaya pipe

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Abb. 12: Diamond crystal from Alkhal

13.07.2007



Abb. 13: 2 pink diamonds

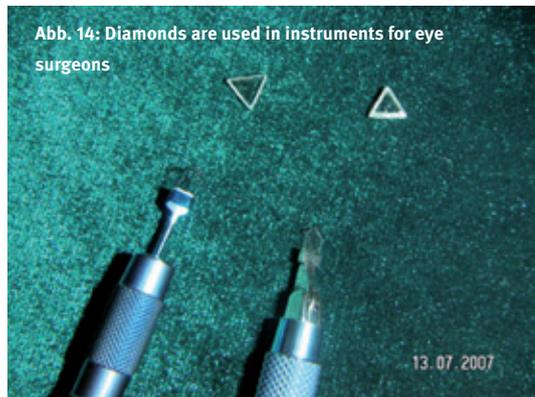


Abb. 14: Diamonds are used in instruments for eye surgeons

13.07.2007



Abb. 15: Yellow, green and brown diamonds



Abb. 16: Pyrop occurs together with diamond in kimberlite

Large diamonds from Yakutia

Every year a number of large diamond crystals are discovered, they are offered for sale to the government-owned Diamond Fund in the Kremlin where some of them are shown to the public.

The largest diamond ever discovered is the „26th Congress of the Communist Party of the Soviet Union“, it weighs 342 carats and was found at plant No. 3 of the Mir pipe in 1980.

In 1991 the 341.8 carat „Free Russia“ diamond was presented to Boris Yeltsin and also went to the Diamond Fund.

Other large diamonds are the „50 years of Aeroflot“ and the „Star of Yakutia“, weighing 232 carats and 239.05 carats each, the „Great Beginning“ with 135 carats and the „Great Bear“ with 114 carats.

INFO

Elisabeth Strack
Gemmologisches Institut
Hamburg
Gerhofstr.19
20354 Hamburg
Tel. + 49-(0)40-352011
Fax: +49-(0)40-343419
info@strack-gih.de
www.strack-gih.de