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Talc mining in Austria: Sustaining activities in the face of scarce resources and competing interests

1. About Rio Tinto Minerals

Rio Tinto Minerals is a member of London-based Rio Tinto, world leader in finding, mining and processing the earth's mineral resources. The organization encompasses 3,300 people working at 50 plants on five continents to serve more than 2,500 direct customers worldwide. Rio Tinto Minerals supplies nearly half the global demand for borates, used in fiberglass, glass, ceramics, detergents, fertilizers and wood preservatives; 25 percent of the global demand for talc, used in paint, polymers, paper, ceramics and personal care products; and is the world's largest salt exporter. The organization is the acknowledged world leader in product quality, supply reliability and technical support – the services that create value for its customers and differentiate Rio Tinto Minerals from its competitors – and is an industry leader in continuously improving the way its products and practices contribute to sustainable development.

Naintsch Mineralwerke GmbH (Rio Tinto Minerals Austria) is the only producer of the industrial mineral "talc" in Austria. The business activities range from the extraction of minerals to their processing by means of patented procedures from the finest milling up to highly specialized solutions that are sold to the industry.

1.1. The owners

Naintsch Mineralwerke GmbH is a company that belongs to Rio Tinto Minerals, a group operating worldwide, dealing with the extraction and processing of talc, salt and borates.

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They are based in Graz/Andritz in Austria. Naintsch operates five sites in Austria. The crude mineral is extracted in two talc mines (Rabenwald near Weiz and Kleinfeistritz near Judenburg). Both sites pursue sustainable safeguarding of the raw material by means of modern simulation models. In the plants in Oberfeistritz and Weißkirchen the crude mineral is processed to high quality products for the industry by means of patented procedures.

1.2. The operating figures

In 2007 Naintsch produced and sold about 180,000 tons of talc and products similar to talc. Naintsch employs about 150 people in five Styrian locations and achieved a turnover of about 55 million Euros in 2007. 85% of the production is exported all over the world. Here, the East European market is becoming more and more important.

The raw material: Talc („steatite“) is the softest mineral in the world. Its outstanding features are the softness, the platelet shaped structure and the water repellent property.

Typical scope of application: Did you know that an automobile contains up to 12 kg of talc? Not only the plastic parts (dashboard, bumpers, carpeting, airbag, tyres etc.) contain talc. The addition of talc allows the fitting of plastic components in the engine compartment. Apart from the resistance to heat talc allows the manufacture of lighter components, the total weight of the vehicle is reduced leading to the reduction of the petrol consumption. In the long run, the plastic parts filled with talc can be recycled in an easier way at the end of the life cycle.

Health and safety: The health and safety of all employees as well as contractors are of vital importance to Naintsch. In 2003 and in 2005 Naintsch was nominated for the Austrian state award and consequently achieved a recommendation as „Best Practise“ in the context of the European Safety Award 2005.

Sustainable development: Raw materials are the basis for the pleasant things of daily needs and increase our standard of living. The extraction of raw material always has an impact on the environment. To keep this impact as low as possible and to consider the concerns of the owners, employees, communities and customers in equal measure, RTM strives for a sustainable development of the company. A balance between the economic success, the social well-being and the protection of the environment is to show the way to assure a long term future.

1.3. The sites

Graz: The head office in Graz-Andritz deals with sales, the central administration and is the headquarters of the business management.

Rabenwald: The biggest talc deposit of Central Europe can be found in the region of Rabenwald near Weiz (Eastern Styria). About 100,000 tons of talc are extracted a year at the open pit in Rabenwald: Rabenwald employs about 35 people in the production and the administration. After completing the extracting operations, the excavated terraces are com-

pletely recultivated. To this date, about 190,000 trees have been afforested serving at the same time as a natural visual protection for the environment. To keep the environmental impact for the region as low as possible, most of the rock is transported to the nearby plant in Oberfeistritz.

Oberfeistritz: Naintsch operates a processing plant for talc in Oberfeistritz. There, the rock is reduced to small pieces, sorted automatically and afterwards milled in various finenesses. This way, the plant with its 40 employees yearly produces about 100,000 tons of preciously processed raw materials for the industry.

Kleinfeistritz: One of the mines of Naintsch is located near Kleinfeistritz (Upper Styria near Judenburg). There, about 20,000 tons of a mineral similar to talc are extracted yearly (Leukophyllit). This mine employing 5 people is the smallest one of Rio Tinto worldwide and meets the highest international safety and environmental standards. The material is transported to Weißkirchen for further processing.

Weißkirchen: Naintsch operates another processing plant at the site in Weißkirchen. Apart from the raw material from the mine in Kleinfeistritz, the plant also processes raw materials from other Austrian and international deposits. By means of most modern milling plants, 80,000 tons of raw materials are produced yearly for the industry. The plant employs 45 people.

2. Regional policies

The Austrian Mining industry is challenged by the competition of interests of diverse stakeholders. While the exploitation of mineral resources is still acknowledged a public interest the use of property as building land and growing tourism are limiting the extension of operations. Mining activities have to care for long term concepts clearly outlined and integrated into the regional policies.

This requires a good knowledge about the potential dimensions of relevant deposits and a long term orientation of business far in advance to well defined mining projects.

In case of the deposits mined by RTM Austria the global structure of the ore bodies are well known and promise an extension of operations lifetime for many decades. It is the policy of the company to observe carefully all areas of future interests and claim for being acknowledged in the regional policies.

3. Orebody Knowledge and Long Term Mine Planning

A resource model is a computer based representation of a deposit in which geological zones are defined and filled with blocks which are assigned estimated values of grades and other attributes. Each mineral deposit presents unique geologic characters, therefore modelling techniques and parameters must be determined carefully to design the most appropriate geologic model and furthermore a mineral resource estimate.

A certain process has to be followed to establish a reliable mineral reserves estimate.

The Resource Database builds the basis necessary for the estimation and is established by the collection, validation and processing of data. A QA/QC program is preferred to administrate the collection of all data. From the beginning concurrent collection of preliminary economic, mining, metallurgical, environmental, legal and social data and other information is required.

The Geological Interpretation targets the definition of geological controls for the mineralization and focuses especially on the understanding of the relationship between the mineralization and the related geological processes that govern its emplacement and geometry within the geological framework. Within this context, construction of lithology domains, economic mineralisation domains, geotechnical domains, and the integration of structural and mine operating data are considered. Finally, the interpretation requires validation before progression to the grade/ quality estimation stage.

The conceptual Geological Model and ideas regarding the genesis of the deposit allows constructing a block model where each geological domain gets filled with blocks of a unique code. These domains also prevent the unrealistic smoothening and spreading of estimated block grades across different lithological zones.

Reliable Mineral Resource Estimates require geostatistical and estimation practices to estimate the required grade and other relevant variables into a suitable block or mesh model. Variables potentially constraining process and mining should be also included. Increasing sophistication of software packages and improved hardware speeds mean that it is now quite easy to perform multiple estimates using different methods in order to compare the results.

For example, non-geostatistical methods, such as nearest neighbour can be compared with geostatistical methods such as kriging. The choice of the appropriate method depends on circumstances, and need not always involve geostatistics, but the analytical work beforehand should give a good idea of which method or methods are likely to be most successful. The selection of the method should be geared to what is required of the result and to the characteristics identified during the preceding modelling steps.

According to CIM 2003 there are a number of quantifying elements or Modifying Factors that should be considered in the conversion of a Mineral Resource to a Mineral Reserve. Industrial minerals within Rio Tinto are covered by the JORC Code and therefore the main elements/factors to be considered include mining, metallurgy, geotechnical, hydrological, environmental, location, marketing, legal requirements, revenue, costs and social implications.

A key criterion for Mineral Reserve Estimate is the determination of economic viability. An important aspect of this is the practicality of the mining and processing methods proposed for the deposit. Optimisation of mining limits and sequencing follows the definition of the mining method and initial mine design. The optimisation is a high level analysis of a strategic nature, taking into account all of the value chain (from resources in the ground through to the customers), to estimate relative NPV for a range of physical, economic and regulatory scenarios. The basic strategy of how the mine is to be developed and sequenced needs to be

determined and incorporated into the Development Strategy. This often determines the timing of key installations as well as milestones such as first ore production. This may have a significant direct impact on NPV and various strategies may be used like inputs to the optimisation process.

The ultimate check of a mineral reserve estimate is through appropriate production monitoring and Reconciliation. The Model to Mine Reconciliation focuses on the comparison of identical volumes of material, one as predicted from the resource model and the other one from the mine production reports. In an operating mine, reconciliation of mine to mill production and mine production to reserve estimates should be conducted on a routine basis. The results of the reconciliation must be considered in the reporting of Mineral Reserves.

4. Excellence in Drilling & Blasting

4.1. Heading for excellence

Rio Tinto Minerals has launched an Operational Excellence program (OpEx) in order to improve competitiveness. OpEx provides a platform for the achievement of goals by improving the speed and quality of improvement initiatives. Operational Excellence is about systematically improving the performance of operations by reducing variability and pushing processes closer to their maximum economic capability.

4.2. Generating Excellence Standards

In a first run key performance drivers (KPDs) are identified and used for the evaluation of the process capability. Performance gaps towards common targets and standards achievements get evident.

For starting the loop improvement process bottom up the KPDs are first cascaded down to the workforce and the workplaces. The workforce is encouraged to track their performance in visual workplace platforms and generate improvement ideas. Progress means measures against past performance.

For inducing step changes new technology and toolkit are implemented in partnership with experts. Communities of practice are consulted for easy exchange of state of the art technology within the company.

4.3. Excellence Standards in Drilling & Blasting on Rabenwald Open pit mine

Drilling & blasting is an important process step which is commonly applied in various operations.

Photo. 1. Blast Metrix Rabenwald

Fot. 1. Blast Metrix Rabenwald

On Rabenwald some 2 million tonnes of waste rock has to be removed; a significant part has to be drilled and blasted in advance.

The process has been mapped in detail from planning to documentation and fragmented into functional chunks. After review and alignment to an optimized work flow the tasks have been documented in standard work procedures and fed back to the workforce. Major steps forward could be achieved by implementing more precise planning tools using state of the art techniques (BlastMetrics) and an improvement of the accuracy of drilling. Detailed documentation of blasting results and tracking results on visual workplace boards ensure the learning progress proceeding well.

5. Project: Plastorit Mine Kleinfeistritz

5.1. Mine on the move

RTM Austria operates a small underground mine located near the town of Zeltweg approximately 100 km northwest of the regional city of Graz in southeast Austria.

The mine produces roughly 20,000 tonnes of leukophyllite (white schist) to be processed at the Weißkirchen Plant producing PLASTORIT, i.e. brand name for mica-chlorite-quartz products as a high value additive for the paint and plaster market.

After an extraction period of 90 years the mining activities had to be moved due to exhaustion of reserves in one area of the deposit. Core drillings in the eastern continuation of the geological structure have been taken as a basis for defining a model of deposit and for proving huge reserves with consistent quality of material for many decades. Mine planning has been guided by geotechnical studies in cooperation with the Mining department at the University of Leoben. Studies resulted in a surface infrastructure and underground mining concept which has been well accepted by all stakeholders involved.

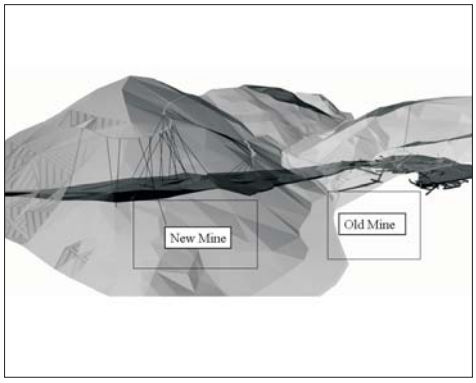

Fig. 1. New and Old Mine Kleinfeistritz

Rys. 1. Nowa i stara kopalnia Kleinfeistritz

Photo. 2. Mine Kleinfeistritz

Fot. 2. Kopalnia Kleinfeistritz

5.2. Social and environmental aspects

The operation is situated in a sensible area which is outlined as a landscape conservation area. Extensive bio diversity impact studies were started early enough in order to align operational planning to environmental requirements from the very beginning. As a result a satisfying consensus could be settled at an early stage of the project. Key factors have been the continuation of underground mining technique and the implementation of a modern back filling system providing minimum impact on the surface affected by mining activities. This mining method assures a maximum recovery and contributes to the sustainability targets of the operation. These efforts have been well appreciated by the local community which has been informed about all steps of the project right in time.

This strategy has also been applied for all clean up activities. Land owners have been involved into the detailed planning based on the long term existing closure plan. Their interests will be considered to an extensive grade. The comprehensive plan for the abundant works tackles the removal of surface and underground installations and the backfilling of near to surface openings. Long term water drainage will be provided, the surface area has to be rehabilitated, kept fenced and controlled via a long term monitoring program. Infrastructure which can be used for forestry (timbering) like roads will be bargemen to land owners.

5.3. Economical Success

Finally this project will provide a major economical success to the company. By implementing new techniques and dimensions the productivity nearly doubles. It fits also well into the emerging demand for Plastorit on the market places.

6. Project: South Pit Rabenwald

6.1. Going South

RTM Austria operates an open pit talc mine at Rabenwald located approximately 40 km northeast of the regional city of Graz in southeast Austria.

The open pit mine produces roughly 100,000 tonnes of talc to be processed at the Oberfeistritz Plant producing MISTRON, i.e. brand name for talc products used in pitch control for paper mills and other products for ceramics, paint industries and roofing.

For a long time period of decades extraction was concentrated at the northern end of the deposit ("North pit"). In order to continue its business the operation proposed to open a new mine in the southern continuation of the ore body in the area of the former Krughof Pit ("South pit"). An extensive exploration program has proven significant reserves and quality parameters well in line with the demand from the market. In a first step approximately 3 million tonnes of waste have to be removed. This will provide access to reserves covering the demand for roughly the next 2 decades. A geotechnical study proving slope stabilities has been done in cooperation with the Institute for Rock Mechanics at the University of Graz. Mine planning was done in house using modern tools providing a maximum value under the restrictions of social and environmental aspects.

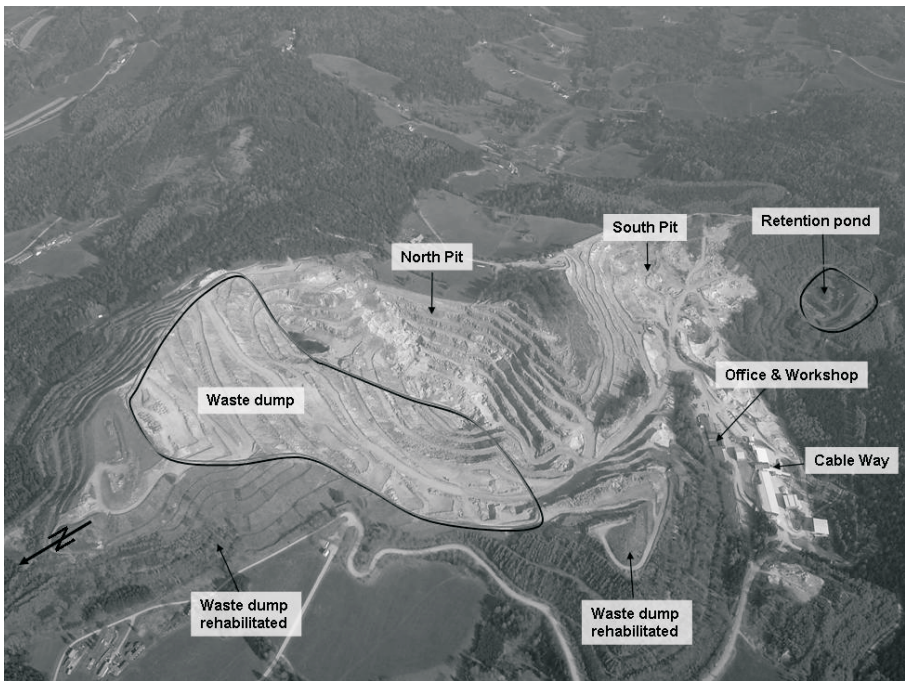

Photo. 3. Open Pit Rabenwald

Fot. 3. Odkrywka Rabenwald

6.2. Social and environmental aspects

As the extraction area is situated on top of the mountain ridge visibility of operation is a major aspect to be considered in advance. In the new South pit the same principle will be applied like in North Pit operation: Dump areas that have been completed will be rehabilitated as soon as possible and protect the pit area against visibility. Waste extracted will be dumped inside the exhausted pit wall to keep the open pit area as small as possible. This aligns also with the target of minimizing dust and noise emissions. A biodiversity base study has been applied and potential impacts considered carefully. Finally great attention was given to the water management concept as the area is an important supplier for the communities.

Local communities and representatives from the nearby Pöllauer Naturpark have been informed and involved in the planning process at a very early stage in order to achieve fully acceptance by all stakeholders. As RTM Austria is a major employer in that region and well known as a company working in an environmentally responsible manner the long term project has been appreciated by the stakeholders.

6.3. Economical Success

A long term continuation of talc extraction in the heart of Europe is a key for an economical success of the company. Excellence in all processes and short logistic distances to customers ensure a sustainable value.

7. Dumping of waste rock

The talc deposit on Rabenwald open pit mine is extracted from the north southbound.

The continuation of the mining activities doesn't cause a significant horizontal mining expansion, yet a vertical one. In doing so, a minimization of the impact on the environment is strived for. The planning criteria that are relevant to the environment are the following:

— Visual, dust and noise protection for the neighbourhood, in particular with regard to the tourist resorts in the valleys. This protection is guaranteed by the mine management using natural and artificial (waste rock) scenes. Particularly the visual protection is realised by means of efficient rehabilitation of completed waste rock dumps.

— Minimization of the surface demands for extraction and waste rock dumps (minimization of the open surface). The minimization of the surface demand could be realised by applying the back in pit dumping concept and by prompt rehabilitation and reforestation of each area where extraction has been completed.

— Measures to guarantee the utilisation of the surface after completing the extraction or mining activities. Rehabilitation is already considered when planning the waste rock dumps and the final state of the open pit area. Representatives of regional authorities determine in accordance with representatives of interested parties for future uti-

lisation which surfaces are to be used in which way after the completion of the mining activities.

— Measures to protect abutting owners and waters: A detailed water drainage plan has been established for the mine on Rabenwald together with the open pit plant management by means of natural and artificial scenes, thus guaranteeing that, in accordance with the extraction plan, the drainage areas of the four concerned receiving waters, their deposition as well as the drainage proportions are only slightly changed and restored unchanged by means of rehabilitation of the final pit area after completion of extraction.

During the extraction all precipitation waters from the open pit are circulated to the clarifier and flood detention basin via the adequately dimensioned drainage ditches as well as the accumulative and inflow channels to such an extent that harmful water emissions can not occur.

7.1. Rehabilitation

The company is aware of the fact that the open pit mining interferes with nature and therefore, their prior target has to be the immediate rehabilitation of areas where extraction has been completed. During the rehabilitation one has to differentiate between a temporary rehabilitation and a final one with reforestation.

During the rehabilitation the temporary completed mine surface is vegetated and replanted thus protecting the surface against erosion.

In doing so, new soil is spread onto the surface, occasionally rehabilitated by means of planting vegetation without humus using a hydraulic spraying method or re-natured with a newly denuded humus. In case of a temporary rehabilitation of small areas, the planting vegetation is carried out the usual way by hand.

Areas finally extracted are rehabilitated immediately, i.e. new soil or humus is spread on top, they are vegetated and after successful planting vegetation they are forested with a typical biodiversity of wood species depending on the altitude. In case of an exposed mine area at an altitude of about 1,100 m these areas are rehabilitated or re-natured as forest area with ecological niche structures, irrespective of the fact if the original cropland was a forest, farmland or waste land.

A large research project called „mine habitat“ was carried out for the planning and evaluation of the ecological value in terms of rehabilitation operations. This includes a survey of about 26 habitat types as well as an evaluation of the measures taken so far for rehabilitation.

A specious and locally typical mixed forest that is in accordance with the habitat has been foreseen to reuse the mine area after completion of the mining activities, with regard to the altitude of the mine as well as the changing climate factors.

The long term target is to avoid a further expansion of the area being claimed by the open pit operations and to restore the original character of the landscape in a technically and

economically possible extent during the safeguarding of the surface utilisation after completion of the mining activities.

Conclusion

Long term mining concepts have to be stated and embedded in regional policies at an early stage. The ore body knowledge is a key from the beginning and allows optimized planning of all further activities. Mine cycle planning has to follow a sustainable approach and involves extraction, dumping, rehabilitation and closure activities. Social and economical aspects have to be treated as well as economical ones. Heading for Operational Excellence assures competitiveness and state of the art appliance for all major activities. The involvement of communities at each step provides broad trust to the company and allows extension projects well accepted by neighbours and other local stakeholders.

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GÓRNICTWO TALKU W AUSTRII: DZIAŁANIA ZRÓWNOWAŻONE W OBLICZU NIEWYSTARCZAJĄCYCH ZŁÓŻ I INTERESÓW KONKURUJĄCYCH

Słowa kluczowe

Zarządzanie biznesem, standardy ochrony środowiska, minerały przemysłowe, wiedza o złożach rud, rozwój zrównoważony [red.]

Streszczenie

Rio Tinto Minerals to globalny największy dostawca produktów talku, które stosowane są w przemyśle farbiarskim, polimerowym i papierniczym. Firma zależna w Austrii użytkuje dwie kopalnie w oparciu o długotrwałe rezerwy złóż. Działania górnicze muszą zawierać wyraźnie nakreślone długotrwałe koncepcje, zintegrowane z zasadami polityki regionalnej. Dla zapewnienia rozwoju projektów należy wcześniej uważnie analizować aspekty społeczne i środowiskowe, aby zagwarantować zrównoważony charakter działalności.

Dążenie do doskonałości: Począwszy od dokładnego modelu złoża, planowanie kopalni jest skoncentrowane na zapewnieniu maksimum wartości dla wszystkich akcjonariuszy z uwzględnieniem aspektów społecznych i ochrony środowiska. Znaczne wysiłki włożono w planowanie hałd i rekultywację istniejącej kopalni odkrywkowej, dla minimalizacji zajmowanej powierzchni i zapewnienia widoczności wszystkich działań górniczych.

Dzięki przestrzeganiu tych zasad, Rio Tinto Minerals pomyślnie rozwinęło istniejącą kopalnię odkrywkową o kolejną odkrywkę i otworzyło nowe działania pod ziemią.

TALC MINING IN AUSTRIA: SUSTAINING ACTIVITIES IN THE FACE OF SCARCE RESOURCES AND COMPETING INTERESTS

Key words

Business management, environmental standards, industrial mineral, orebody knowledge, sustainable development [red.]

Abstract

Rio Tinto Minerals is the global number one supplier for talc products, which are found in the paint, polymer and paper industries. The subsidiary in Austria operates two mines both based on deposits bearing long term reserves. Mining activities have to care for long term concepts clearly outlined and integrated into the regional policies. For extension projects social and environmental aspects have to be studied carefully in advance to guarantee the sustainability of operations.

Heading for excellence: Starting with a precise model of the deposit mine planning is focused on providing maximum value for all stakeholders including environmental and social aspects. Great efforts are made in planning dumps and rehabilitation in the existing open pit mine minimizing the footprint and visibility of all mining activities.

By respecting these principles Rio Tinto Minerals has successfully expanded an existing open pit mine for another pit and opened up a new underground operation.