



The Economic Importance of Mineral Resources in Austria

A study by the
Institute for Industrial Research - IWI



FORUM

MINERALISCHE
ROHSTOFFE
BASIS UNSERES LEBENS

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Introduction

Mineral resources form the basis of our daily life. Their availability is essential for innumerable goods in everyday life and for the Austrian economy as a whole.

The Forum mineralische Rohstoffe, the stakeholder platform of mineral extracting companies in Austria, has commissioned a study attempting for the first time to quantify the economic relevance of the extraction of minerals for the Austrian national economy.

On the one hand, the focus of the study is on the link of the mineral resources sector with its direct and indirect suppliers (backward linkage). It shows what value added, pre-tax payrolls and how many jobs are generated by the extraction and processing of minerals and by the gross capital formation of the sector.

On the other hand, a forward linkage perspective is applied in order to analyse the role of the sector at the beginning of the value creation chain as a supplier to other economic areas.

In that context, a central issue of the study is the calculation of a hypothetical bottleneck scenario, which reveals the great vulnerability of the national economy to a shortage of mineral resources.

The data base of the study performed by the Institute for Industrial Research (IWI) is an input-output analysis of the Austrian economy in 2002, because for this year the necessary statistical data is available. Further data sources were needed in particular for the estimation of physical production and comprise amongst others the official industrial statistics provided by Statistics Austria and the Mining Handbook published by the Ministry of Economics.



Dr. Carl HENNRICH
Managing director Forum Rohstoffe



Komm.Rat Gerold NEUPER
Chairman Forum Rohstoffe

MINERAL RESOURCES BALANCE

Conclusions

In 2002 the **domestic supply** of mineral resources (according to the definition underlying this study) was **1,106.2 million EUR** or, in physical terms, **100.1 million tons**. Of this total amount, natural stone (CPA 14.1) accounts for 318.8 million EUR and gravel, sand, clay and kaolin (CPA 14.2) for 787,4 million EUR. Apart from the raw material sector itself, there are also others, e.g., agriculture, local authorities, transport and the construction industry, which participate in extracting and processing mineral resources.

The **total production** generated by the analysed sector in the national economy exceeds **2.1 billion EUR**. The generated **added value** totals up to **1 billion EUR**.

14,559 jobs are being secured including 9,739 jobs in the production of other goods or services.

Furthermore, in 2002 the sector of extraction and processing of minerals invested about 29.8 million EUR, including only capital goods of domestic supply.

Table 1

The most important backward-linkages ¹

- production of more than 2.1 billion EUR
- value added of more than 1 billion EUR
- 14,559 jobs
- almost 10,000 of 14,559 jobs generated in other economic sectors

Breaking down the results into the factor “production” and “investment” gives the following shares (see Fig. 1 on next page):

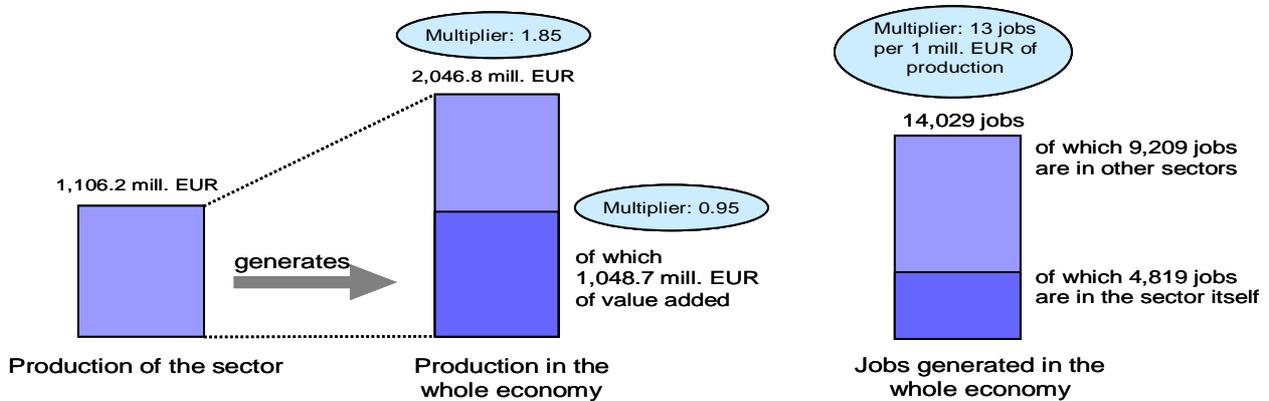


¹ In an economy based on division of labour the various industries require inputs from other industries which in turn require inputs from other industries again. These interdependences, which link a particular sector with its direct and indirect suppliers of intermediate goods, are termed “backward linkages”. In addition to the direct effect generated by a final demand impulse these interdependences create indirect effects via the chain of intermediate inputs.

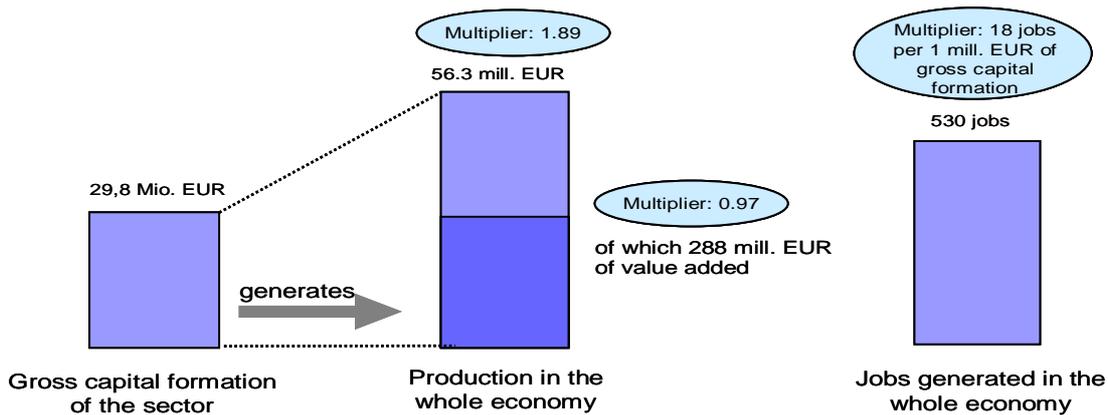
Fig. 1

Macroeconomic effects of production activities and gross capital formation of the mineral resources sector

Macroeconomic Effects due to Production Activities



Macroeconomic Effects due to Gross Capital Formation



Production activities generated the following effects on the Austrian economy:

Production:	2,046.8 million EUR
Value added:	1,048.7 million EUR
Employment:	14,029 jobs

Per 1 million EUR production of mineral resources the following was generated:

Production:	1.85 million EUR
Value added:	0.95 million EUR
Employment:	13 jobs

From gross capital formation generated, the following were the effects on the Austrian economy:

Production:	56.3 million EUR
Value added:	28.8 million EUR
Employment:	530 jobs

Per 1 million EUR gross capital formations the following was generated:

Production:	1.89 million EUR
Value added:	0.97 million EUR
Employment:	18 jobs

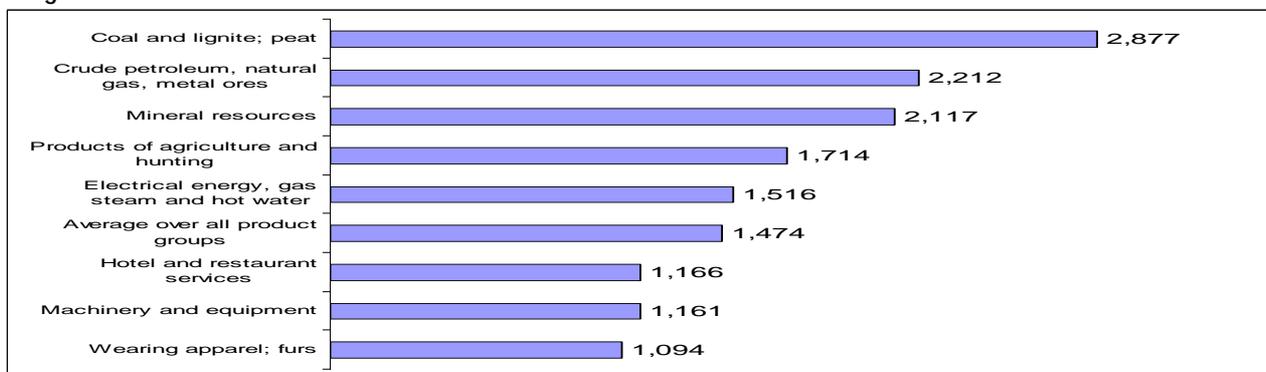
Fig. 2

Production multipliers of production activities in comparison with selected sectors



Fig. 3

Length of the value creation chain for selected sectors



With respect to its production activities the sector of mineral resources has a production multiplier of 1.85 (per 1 million EUR of production of mineral resources a total production of 1.85 million EUR is generated). In comparison with other sectors this multiplier is slightly above the average of 1.72.

As to the effects stemming from its gross capital formation the sector has a multiplier of 1.89, implying that for every million EUR that the mineral resources sector spends on capital goods of domestic supply, a production of 1.89 million EUR is generated in the national economy. This multiplier is nearly the same as the average over all sectors.

With the analysis of the value creation chain (what share of the production in downstream sectors can be attributed to the direct or indirect intermediate input of mineral resources?) a forward-linkage-measure of 2.177 is found.

This measure indicates the length of the value creation chain for a particular product. Mineral resources enter the production process in other sectors, e.g., construction works, production of glass.

Each unit of production of the sector of mineral resources passes through a chain of production and transformation processes until in the end of the value creation chain a final consumer (e.g. user, export) receives a product.

In comparison with other product groups this measure is particularly high, which indicates the great relevance of mineral resources for downstream sectors.

The bottleneck scenario shows that with a progressive tightening of the bottleneck there is a disproportionately high loss of production in the national economy because the intermediate goods needed in downstream sectors are no longer fully available.

Thus, a reduction of 30 percent in the production of mineral resources due to a bottleneck would mean a production loss of 332 million EUR in the sector itself while in the national economy a production loss of 3,100 million EUR is caused. This is 9.34 times as much - reflecting the fact that such a bottleneck cannot easily be compensated as many sectors strongly depend on mineral resources (see tab. 5).

Mineral resources - an essential good

Buildings, roads, canals, glass, TV sets, computers, mobile phones, pharmaceuticals, cosmetics and more would not exist without mineral resources. In Austria every year more than 100 million tons (to be precise 100.1 million tons) of mineral resources like sand, gravel, crushed rock, limestone, clay, marl, slate, gypsum and industrial minerals are required. Each Austrian citizen uses 12 tons of mineral resources on average per year. A typical one-family house contains about 450 tons of mineral resources. Construction of an 80 m² flat requires around 100 tons of mineral resources. For a single kilometre motorway about 160,000 tons of mineral resources are needed. Even cosmetics and pharmaceuticals could not be produced without mineral resources.

The above mentioned number of 100.1 million tons results from a quantity estimation carried out as part of the present study. The aim was to obtain numbers in physical terms where numbers in monetary terms are available. The corresponding sum of the production of the sector of mineral resources in monetary terms is 1,106.2 million EUR. Available quantity estimations, which are based on data from Forum mineralische Rohstoffe, were to be revised since the official statistical basis, the industrial statistics of Statistics Austria, does not account for several factors. To mention the main aspects, the industrial statistics in most (sub)sectors samples only companies with more than 20 employees and does not cover the service sector. Statistical confidentiality requirements also affect the data availability in some areas. For every one of these causes of incomplete statistical coverage a corrective estimation must be carried out (see Tab. 2). The result of this procedure is the estimation of the sum of 100.1 million tons of mineral resources, which accords well with the experiences and estimations previously made by Forum mineralische Rohstoffe.



Table 2

Quantity estimation of mineral resources

- based on the industrial statistics of Statistics Austria using other data sources to obtain substitute figures for subsectors affected by statistical secrecy requirements
- corrective estimation for incomplete statistical coverage of companies with less than 20 employees
- estimations for sectors not covered by the industrial statistics of Statistics Austria (e.g. transport industry)

Results of the quantity estimation

(Austrian CPA product groups)

➤ natural stone (CPA 14.1)	4.8 million tons
➤ gravel, sand, clay and kaolin (CPA 14.2)	95.3 million tons
➤ mineral resources (sum)	100.1 million tons

MINERAL RESOURCES

Necessary for other industry sectors



Mineral resources constitute an important **intermediate input** for a number of other sectors.

Of the total production of mineral resources in 2002 amounting to 1,106.2 million EUR a share of 76.7 % (= 848.0 million EUR) is distributed to other sectors and enters the production processes in these sectors. 23.3 % (= 258.3 million EUR) are delivered to final demand (exports, construction of dwellings, private consumptions).

Two sectors, **construction works and non-metallic mineral products** are the main consumers of mineral resources. Together they use nearly 90 % of the domestic supply of mineral resources.

The sum of 258.3 million EUR of final demand for domestic mineral resources can be broken down into exports (186.7 million EUR), private consumption (33.3 million

EUR) and gross capital formation (38.7 million EUR).

In the year 2002, the production of mineral resources required domestic intermediate inputs of 446.1 million EUR.

As above mentioned, mineral resources sector creates demand for the products of the other sectors not only by its production activities but also by its gross capital formation. In 2002 the sector invested 29.8 million EUR in domestic capital goods.

Table 3

The top 5 purchasing sectors:

➤ construction work	508.9 million EUR
➤ other non-metallic mineral products	156.6 million EUR
➤ other mining and quarrying products	30.4 million EUR
➤ public administration services etc.	27.7 million EUR
➤ pulp, paper and paper products	27.3 million EUR

Table 4

The top 5 supplying sectors:

➤ land transport and transport via pipeline services	108.2 million EUR
➤ other business services	49.4 million EUR
➤ electrical energy, gas, steam and hot water	47.7 million EUR
➤ wholesale and commercial trade service, ex. of motor vehicles	35.9 million EUR
➤ other mining and quarrying products	30.4 million EUR

Domestic supply

The **demand** for mineral resources is supplied nearly exclusively by **domestic deposits**. In Austria there are around **1,300 active and inactive extraction sites**. Due to reasons of costs, mineral resources are regularly transported only up to 30 kilometres, i.e. the extraction site and the processing plant or building site are usually separated by not more than 30 kilometres.

As a result, **on average in every second Austrian municipality an active extraction site is situated**.

Mineral resources extracting companies constitute an important source of **regional added value**. They guarantee an excellent provision in the locality and, because of short transport distances, traffic, environment and abatement are reduced.



MINERAL RESOURCES ECONOMY

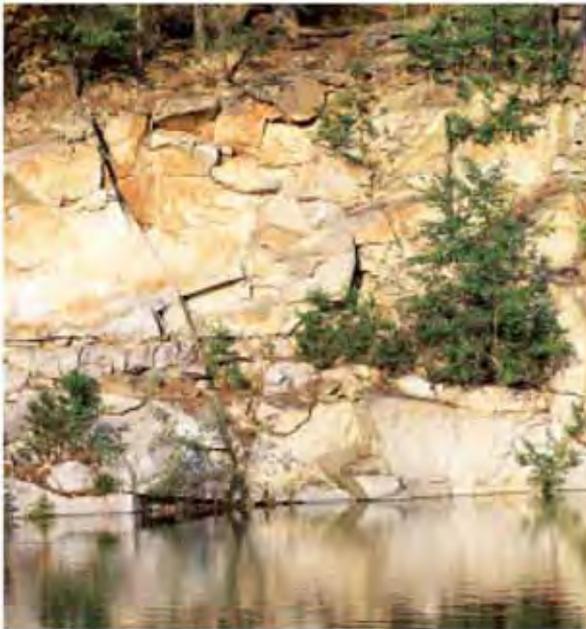
An important local employer

Both the **mineral extractive industry** itself and the industries of subsequent processing - in particular the construction industry - **provide thousands of jobs** and contribute considerably to the gross national product. The over 900 sand and gravel pits and more than 250 quarries provide about 6,000 jobs, most of them **in small towns and in regions** where secure jobs are rare.

The **construction industry**, which is linked to the mineral resources sector, **provides more than 250,000 jobs**. These jobs can be considered as secured by the mineral resources economy as well. Thus, the mineral resources extractive industry makes an important contribution not only to the national economy as such but also to national employment.



Use of nature - protection of nature



The extraction of mineral raw materials involves interference with nature, since even the most ecological extraction technologies have an impact on the landscape. But there is a long established agreement in the industry that long-term economic success can only be secured by embracing the principles of **environmental protection** and taking care of the **needs of the people**.

A highly developed ecological consciousness and a sense of responsibility for nature are prevailing in the Austrian mineral resource extractive industry and can be seen as its trademarks, as acknowledged by **WWF Austria**, with whom the **industry collaborated since 1998** in the field of the protection of species and nature.

Several million EUR have been spent during the past 10 years on **restoration and rehabilitation** of closed extraction areas, thereby **creating valuable wildlife habitats** for endangered animal and plant species included in the 'Red List'. The first successes of the species protection projects were soon noticeable: By now the eastern part of Austria accommodates **26 stone-curlew pairs** and **80 bee eater colonies**. In sand and gravel pits both bird species find ideal breeding conditions and have a well-sheltered refuge for their offspring.

Also the **green toad**, which is endangered too, the **natter jack toad**, the **dragonfly** and the **eagle owl**, needing the cliff rock-faces of quarries, have settled down in closed extraction sites. Furthermore, numerous individual projects of member companies have been originated by the **cooperation between Forum mineralische Rohstoffe and WWF Austria**.

AN INDUSTRY PROVIDING MATERIALS FOR MANY PRODUCTS

Subsequent processing of mineral resources

Almost 90 percent of mineral resources are being used by the construction industry. Infrastructure has the largest share. About 60 million tons of sand, gravel and natural stone are needed every year for the maintenance and construction of roads and infrastructure above and below ground, e.g. industrial and residential buildings, rail and canals. About 30 million tons are being used for the production of various construction materials, like cement, plaster, mortar, armour stone, bricks and precast concrete blocks and ready mixed concrete.

Silica sand, dolomite, lime and sodium carbonate are important raw materials for the **production of glass**. Mineral raw materials are also **essential ingredients** for many articles of daily use like cosmetics, TV sets, computers, paper, varnish, colour, mobile phones and even food. Tempting artificial sandy beaches in the midst of the city, secure roads in the winter and detergents - many things that seem natural in every day life - would not exist without mineral resources and the work of the mineral resource extractive industry.

The agricultural sector also needs mineral resources. For example, limestone powder is needed in agriculture and forestry as a fertilizer and for the purpose of neutralising acid soils. Powder of stone is contained in household detergents for its mechanical cleaning effect and in cosmetics and pharmaceuticals as a carrier substance.

Another important example is toothpaste, which contains hydrated silica in micro particle form helping the cleaning process in a smooth way.



Security of mineral resource supply in Austria



Like the agricultural sector, the extraction of mineral raw materials belongs to primary production, laying the indispensable foundation for all subsequent production. In view of competing demands for the use of nature, it becomes ever more difficult to provide the Austrian economy with suffi-

cient quantities of mineral resources at affordable prices.

As an industrialised economic area, Europe has a high demand for mineral raw materials, e.g. sand, gravel, crushed rock, limestone, gypsum and industrial minerals. At the same time the social acceptance of mineral resources extraction is constantly diminishing, mainly because of the lacking knowledge of the people about the relevance of mineral resources for the functioning of the economy. The strategic relevance of non-energetic resources, in particular of building materials, for the economic development in Europe is not sufficiently recognised by most EU member states.

In order to be able to keep fulfilling their role as employers and local suppliers, the mineral resource extracting companies claim provision for securing, making accessible and using mineral resource deposits in Austria. The security of mineral resource supply is a strategic issue for the future, concerning both the industries depending on this sector and the domestic economy as a whole. A precondition for long-term use, zoning plans are reliable data on the economic relevance of mineral resources, as collected by the present study.

In order to explore how a limitation on the production of mineral resources impacts on the Austrian economy, the present study calculated the effects within a hypothetical bottleneck-based model.

The basic assumption of the model is that, caused by external influences, the production of mineral resources is curtailed by 10 %, 30 % or 50 %. How will such a bottleneck affect the production in the national economy, assuming furthermore that the technology used for production and the import relations will be stable?

The analysis shows that with a progressive **tightening of the bottleneck** there is a **disproportionately high loss of production in the national economy** because the intermediate goods needed in downstream sectors are no longer fully available. A bottleneck-related limitation of the production of mineral resources by 30 percent would imply a **loss of production of 332 million EUR in the sector itself but of 3,100 million EUR in the national economy**, which is 9.34 times as much. Production losses in that dimension cannot be easily compensated by the national economy.

The sectors most strongly affected in case of a bottleneck are non-metallic mineral products (CPA 26), i.e. products such as glass and bricks, and construction works (CPA 45), because as a consequence of the bottleneck those sectors that rely most on the inputs of the curtailed sector are constricted with respect to final demand before the other sectors.

In **Austria** the first essential steps for the development of a **national plan concerning the securing and long-term provision of mineral resources** have already been taken.

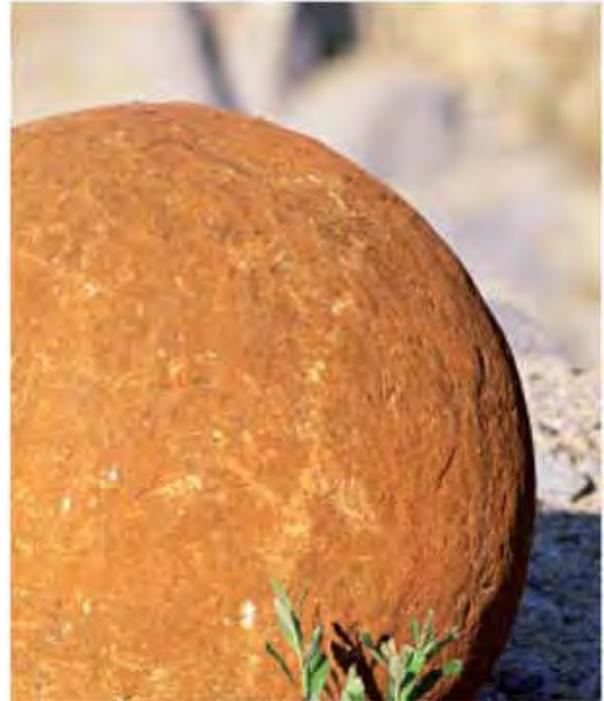


Table 5

Impact of selected bottleneck scenarios on the production in the national Austrian economy, assuming the economic structure and technology of the year 2002

Bottleneck related reduction of the production of mineral resources by	Reduction of the production of mineral resources	Loss of production in the economy as a whole	Reduction of the production of mineral resources
	in 1.000 EUR	in 1.000 EUR	per unit
10 %	110,621	173,307	1.567
30 %	331,863	3,100,299	9.342
50 %	553,104	16,749,924	30.365

Source: IWI Research, input-output table 2002

SUSTAINABLE PROTECTION OF MINERAL RESOURCES

The Austrian Mineral Resources Plan



By the resolution of the Austrian National Assembly E 106-NR/XXL GP, Nov. 21st, 2001, the Minister of Economics and Labour has been called upon to prepare an **Austrian Mineral Resources Plan** in an adequate time, which is documenting the deposits of required mineral resources. On the basis of a cartographic compilation of the deposits and by linking this information with the corresponding demand, a nationwide extraction plan has to be prepared in collaboration with federal and provincial administrations, which forms the basis for individual extraction plans.

The aim of the Mineral Resources Plan is to identify deposits and occurrences of mineral resources and to secure them for balanced and coordinated use in the future, taking account of all conflicting interests

related to protection of nature and environment, groundwater protection and other legitimate demands for nature and land use. One of the most important requests of the Austrian resource policy concerns the optimal use of mineral resource deposits, i.e. prevention of overexploitation, reduction of the use of surface area, keeping the use of primary resources as low as possible, reactivation of closed extraction sites when this is possible and avoids opening up of new extraction sites, application of low-emission and ecological technologies, etc.

Phase 1 of the Austrian Mineral Resources Plan comprised the collection of facts and the building of a consistent data base for the identification of mineral resource occurrences.

Phase 2, which is more essential, has been started at the end of 2006 and provides the settlement of conflicts between federal and provincial administrations with respect to resource occurrences which have been identified based on **system analytical evaluation methods**. With the integration of experts of provincial administrations and industry representatives, this process involves the linking of the information on resource occurrences with the information on other land use demands like land development, Natura 2000, forest use and groundwater protection.

The result should secure the long term accessibility of deposits, the secure and affordable provision of the population with mineral resources and the basis for frictionless permission of mineral resource extraction sites.

From a resource policy view, the Austrian Mineral Resources Plan is the main instrument for the long-term assurance of the extraction of mineral resources in accordance with the needs of the population.



IMPRESSUM

Herausgeber und Medieninhaber:
FORUM ROHSTOFFE im Fachverband der Stein- und keramischen Industrie
Für den Inhalt verantwortlich: Dr. Carl Hennrich
Alle: A-1045 Wien, Wiedner Hauptstraße 63, Postfach 329
T +43 (0)5 90 900 - 3534 | F +43 (0)1 505 62 40
E steine@wko.at | www.ForumRohstoffe.at

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