17* international Mining Congress and Exhibition of Turkey- IMCBT2001, ©2001, ISBN 975-395-417-4

Mining and Society: No Mining, No Future

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ABSTRACT: At present, mining as a supplier of raw materials is an important foundation of our society. In order to give an initial overview of the world mining industry, some facts and figures are presented, such as the annual production of mining products compared to that of other commodities, the share of mining products in world trade, and the contribution of the mining industry to gross domestic product. How important mining is for society is illustrated by means of the dependence of the world's primary energy production on mineral fuels and by means of the average consumption of mining products per person in the world. To demonstrate the global presence and the actual role of mining products in everyday life, a car and the raw materials required to build it is taken as an example. By extension from the present, an outlook for the future role of mining in society is given. Although it is incontestable that renewable energy sources and recyclmg will play an increasingly large role in society, mining will remain indispensable in the next few decades and beyond İn satisfying society's demands for energy and raw materials.

1 INTRODUCTION

Mining affects the natural environment. The use of mineral fuels causes CO2 emissions and global warming, and mining consumes non-renewable resources. These facts lead to the impression that were mining to be stopped immediately, everybody could drive home and look forward to a better future. But the situation with mining is not that simple. Without mining there would be no homes; there would be no fuel or cars to drive. Without mining there would be no future for anybody to look forward to. Mining has been the foundation of society since the earliest times. The beginning of mankind is often dated to the time of the first use of tools. These tools were made of flint mined from the earth. This aim of this paper is to point out the importance of mining for society now and in the future.

2 WORLD MINING - PRESENT FACTS AND FIGURES

In any discussion of world mining, it is normal to first look at world mining production. The global mining production of different commodities is shown in Figure 1. All in all, total production was around 31 billion t in 1998. If one relates the overall mining production to the '98 world population of 5.9 billion people, this means that every single inhabitant of the world needs at least 5 t of mining products per year For the year 1900, the same calculation results in a figure of 0.5 t per person per year. The expansion of world mining in this century has been encouraged by two factors; firstly, by the exceptional growth in the world population, and secondly, by a growing demand for mining products per inhabitant. Projecting the present figure of 5 t per person per year over an expected life of 60 years, every human being will roughly consume more than 3001 of mining products (Figure 2), with natural aggregates and mineral fuels accounting for a share of more than 90%. Of course, this average differs substantially between industrialised and developing countries. For example, in Germany the lifetime consumption of raw materials per person including natural aggregates has been calculated to be around 1,2301 (Wellmer & Stein, 1998).

A comparison of mining and the primary industry sector of agriculture, fishery and forestry is shown in Figure 3. For example, in 1998 production of cereals amounted to 2 billion t, production of wood to 3.5 billion t and the total production was 13.4 billion t. Thus, the tonnage of overall mining production is 2.3 times higher than the tonnage of the overall production of agriculture, fishery and forestry. It should also be mentioned that this level of agricultural production would be impossible without mineral fertilizers provided by the mining industry.

World Mine Production 1998 (1000 t)	
Diamonds	0 03
PGM	0 30
Gold	2 50
Electronic Metals	3 20
Silver	16
Cobalt	23
Niobium, Columbium	29
Tungsten	33
Uranium	35
Vanadium	45
Antimony	81
Molybdemum	135
Mica	195
Tin	219
Magnesium	380
Zirkonium	397
Dısthene	538
Graphite	590
Boron	776
Nickel	1,100
Asbestos	1,790
Dıatomıte	2,190
Titanium	2,770
Lead	3,180
Chromium	4,160
Fluorspar	4,750
Barytes	5,800
Zinc	7,400
Talcum	7,600
Manganese	8,500
Feldspar	8,600
Bentonite	9,600
Magnesite	12,000
Copper	12,300
Peat	26,000
Potash	26,000
Aluminium	28,000
Terra alba	38,000
Phosphate	45,000
Sulfur	56,000
Gypsum	102,000
Salt	190,000
• ndustoal sands	300,000
Clay	500,000
Iron	563,000
Lignite	848,000
Natural Gas (Oil Equivalent)	2,121,300
Crude Oil	3,578,000
Hard Coal	3,740,000
Quarry Stone	4,100,000
Sand & Gravel	15,000,000
TOTAL	*31,356 538*

Figure I World mining production, 1998 (WellmerA Wagner, 2000)

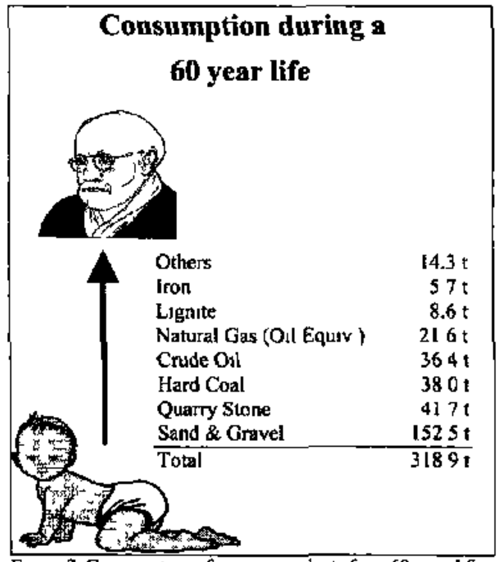


Fıgure 2 Consumptıon of mınıng products for a 60 year lıfe expectancy

The figures for global mining production only" show the tonnage of real mining products. The total world mass moved by mining is 17.8 km^3 of rock per year (Figure 4). This is four times the amount moved by rivers before the influence of mankind (Neumann-Mahlkau, 1996). A rock volume of 17 8 km^3 would be sufficient to cover the total land area of the Netherlands, which has an extension of 37,333 km^2, to a depth of 0.5 m. Thus, mining is expected to be by far the biggest mass mover in the world.

World Agriculture, Fishery and Forestry Production 1998 (10001)	
Cereals	2,079,928
Roots & tubers	648,132
Sugar crops & sweeteners	1,515,473
Pulses	56,123
Nuts	6,767
Oil-beanng crops	478,749
Vegetables	549,838
Fruits	510,217
Feedstuffs	3,144,275
Beverage crops & spices	18,139
Vegetable Fibres	18,435
Livestock products	777,300
Fishery products	113,100
Forestry products*	3,521,000
TOTAL	13,437,477

** Wood calculated at a density of 0 8 t/m'*

Figure 3 World agriculture, fishery and forestry production (FAOSTAT database)

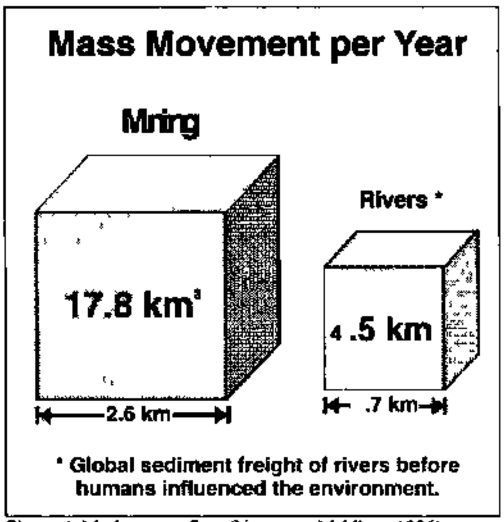


Figure 4. Mining mass flow (Neumann-Mahlkau, 1996).

So as to give an idea of the economic impact of world mining, the contribution of mining to the world gross domestic product (GDP) can be estimated. The total value of global mine production in 1998 was about US $1,000 billion. Compared with the world GDP in 1998 of a little less than US $30,000 billion, this means the contribution of mining is roughly 3% of world GDP.

Another interesting aspect of mining is its position in world trade (Figure 5). The total value of world exports of mining products in 1999 was US $556 billion or around 10% of total world exports. The export value of fuels was US $401 billion or 7% of total world exports (WTO, 2001).

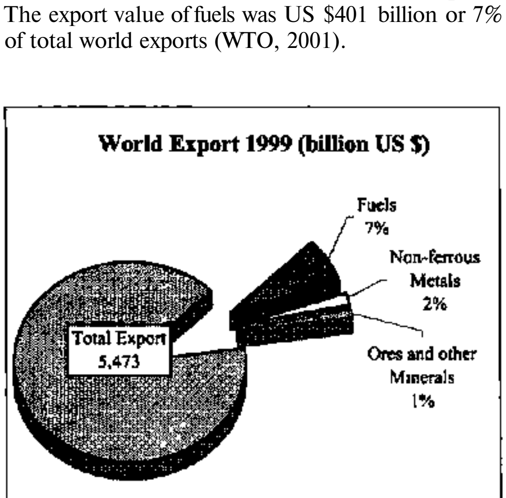


Figure 5. World mining and trade (WTO, 2001).

In this respect, the first impression of mining is confirmed. Mining produces incredible mass flows in connection with fundamental impacts on nature. The economic significance of mining related to its contribution to the GDP and world trade is rather small. So, what is the benefit of mining and what exactly does it signify for mankind?

One of the omnipresent outputs of mining is energy. The world production of primary energy in 1995 was 363.04 quadrillion Btu. This energy was provided almost entirely by coal (25%), oil (40%), natural gas (21%) and uranium (6%). Only 8% was supplied by renewable energy sources (Figure 7).

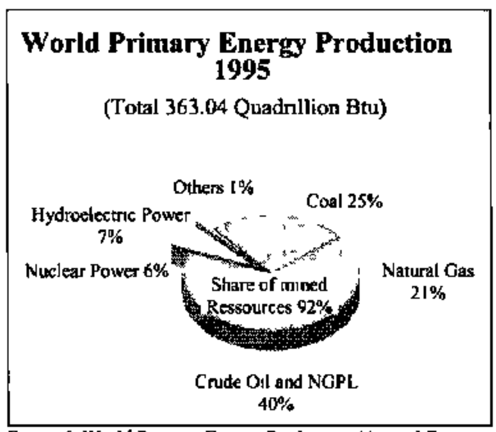


Figure 6. World Primary Energy Production (Annual Energy Review, 1996)

More than 92% of the world's primary energy production is based on mineral fuels. In other words, if mining and mineral fuels were to be taken away, immediately, 9 out of every 10 lights would go out, 9 out of every 10 cars would not run, 9 out of every 10 heaters would stop working, and so on.

All of these figures can only give a rough impression of the importance of mining for society. The best way to show how essential mining is for society is to have a look at everyday life and the things surrounding us. For instance, let's have a look at die car. Figure 7 shows how many mining products are needed to build a single car. All together, around 5,000 kg of ore and other mining products are required to produce a car, and this is only one example. Nothing that surrounds us would be possible without mining. In other words, mining products are a part of almost everything.

Coming back to society's attitude towards mining, which is often focused exclusively on the negative impacts on the natural environment, It must be said that mining transfers natural resources from nature to society, and therefore mining is impossible without minimum impact on nature. On the other hand, it ıs the aim of this article to clearly point out that we all need mining products to satisfy our needs. An additional aspect is the fact that unlike traffic, agriculture or urban development, the impact of mining on nature is often confined to a limited period of time. Reclamation often takes place after mining operations, restoring nature to its original state.

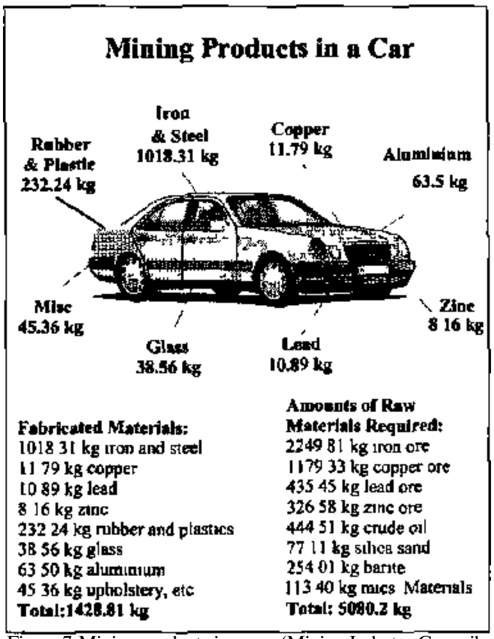


Figure 7 Mining products in a car (Mining Industry Council Missouri, 99)

At this point, it should also be mentioned that nowhere else is the depletion of natural resources more omnipresent than in mining, and that nobody else is more aware of the limitation of natural resources than a miner. However, a critical note is that the mining industry often regards natural resources simply from the aspect of the deposit itself.

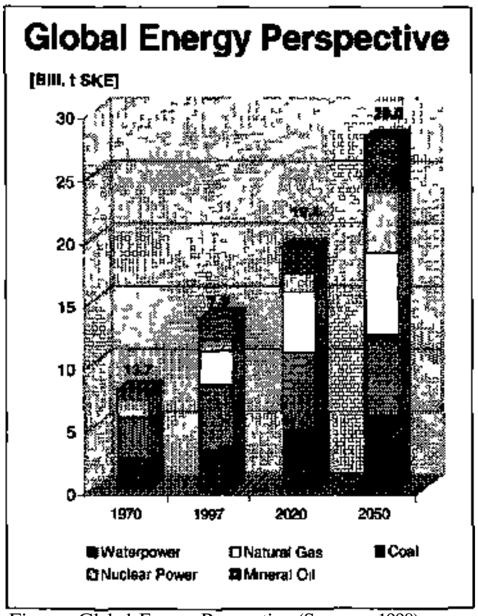
3 WORLD MINING - FUTURE DEVELOPMENTS

AU of this shows that mining is an important foundation of our present society. But that does not justify everything the mining industry does. Mining now and in the future has to take place in an ecologically, economically and socially justifiable way. Miners and non-miners have to come together to realise that aim. The goal must be to handle limited natural resources m a responsible manner Recycling and the use of renewable energy sources must be encouraged So, let us now take a closer look at these two aspects m the future.

The question of future developments m the world energy supply was discussed at the 17th World Energy Congress in Houston in 1998 (Semrau, 1998). With respect to the importance of primary energy supplies from mimng, the congress came to the following results: the restructuring of our energy system towards the use of regenerative energy supplies will be possible m the long term, approximately into the second half of the next century During the next decades, however, primary energy supplies from mining will shll dominate in meeting the increasing demand for energy, especially in developing countries and in threshold countries. For this purpose, however, efficient and ecofhendly technology for energy supply will be required.

A scenario of four steps was drafted

1 Improvement of technologies for the current energy system, i.e., technologies for fossil energy carriers until approximately the year 2015.
2. Development of new technologies to supply current conventional energies until approximately the year 2050.
3 Additional use of new energy systems on a small scale until approximately the year 2050
4 Use of regenerative energy sources on a large scale, from approximately the year 2050 onwards.



Figures Global Energy Perspective (Semrau, 1998) .

The development of world energy consumption could, for instance, look like a scenario in the study "Global Energy Perspectives", which was submitted by the International Institute for Applied Systems Analysis (IIASA) and the World Energy Council (Figure 8).

It can be said that at least until the year 2050, and probably longer, mining will have an outstanding role in the world energy supply.

The question of the future significance of mining for supplying mineral resources may be clarified by taking a look at the metals sector. In 1992, the consumption of the non-ferrous metals aluminium, copper, zinc, lead and tin amounted to around 46 Mio. t in the western world (Figure 9). The proportion of secondary resources in total resource consumption varied between 18 % for zinc and 52 % for lead. This means that a considerable part of the consumption *of* these metals is already covered by recycled materials. Incidentally, this is also true of natural aggregates, where hardly any improvement can be expected in recycling rates, at least in highly populated areas.

Consumption of Base Metals in the Western World 1992

	Overall-consumption (Mt)	Used material in smelters, refineries and other products (Mt)	Used material in %
Aluminium	22 24	6 27	28 20
Copper	12 26	4.60	37.50
Zinc	6.47	1.54	23 80
Lead	4 69	2 43	52 00
Tin	0 20	0 04	17 90
Total	**45.86**	**14.87**	**32.40**

Figure 9. Consumption of Base Metals in the Western World (Metalstatistics, 1993).

However, it remains doubtful whether there will be a further increase in the proportion of recycling during the next decades due to the growing demand for resources. Recycling as a source of resources has its technical, economical and also ecological limits, since a recycling quota of 100 % would only be possible with high inputs of energy and other resources, so that precisely from the point of view of resource-saving, a recycling quota of 100 % is not desirable. Consequently, mining will remain an important, maybe even the most important, supplier for the worldwide demand in resources in the long run. This is confirmed by a look at the statistical lifespans of some resources (Figure 10) (Wellmer, 1998).

Statistical lifespans could indeed give the impression that the world's important resources, such as petroleum, lead and zinc, will be exhausted sometime in the next decades. However, this is not the case, because if one considers the development of the statistical lifetime of supposedly scarce resources over the years, it can be seen that this has remained constant for decades. For instance, in 1955 the statistical lifetime of zinc was around 25 years, yet there are still no signs of a scarcity of this resource. On the one hand, this is due to the fact that new deposits are still being discovered today. On the other hand, technical progress enables mining to exploit deposits, the exploitation of which would have been unthinkable some years ago. The quality of mining operations will continue to be improved in the future in every respect so that they may meet growing requirements.

Statistical Lifespan of Mineral Resources

raw material	unit	world resources 1996	world output 1996	statistical lifespan (years)
bauxite	1000 t	22983000	114000	202
lead	1000 t	63400	2912	22
copper	1000 t	311500	11006	28
zinc	1000 t	143200	7283	20
tin	1000 t	7190	196	37
crude oil	10^6 t	147700	3379	44
petroleum gas	10^9 m^3	149000	2330	64
hard coal	10^6 t	637000	3806	167
brown coal	10^6 t	221000	883	250
uranium	10^3 t	3220	36 2	89

Figure 10. Statistical lifespans of different mineral resources (Welimer, 1998).

Consequently, two things can be said about the future significance of mimng. One is that until the second half of the next century the world energy supply will depend largely on primary energy sources obtained by mining. The other is mat in the future, like today, the demand for mineral resources will essentially be met by mining.

4 CONCLUSIONS

The development of mankind and its standard of living have always essentially depended on the availability of mining products. Technical progress in the past and today is unthinkable without the raw materials provided by mining. Miners have always been aware of the fact that their work is an intervention in nature and that they remove non-renewable resources. As a mining university, we emphasise this responsibility and teach environment- and resource-friendly methods.

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