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Joachim Harder (1952) studied process engineering at Braunschweig University of Technology and earned his Ph.D. there. After more than 10 years working in industry in various management posts, in 1997 he established the OneStone Consulting Group, which is made up of three companies. Dr Harder is an acknowledged expert in international marketing, specializing in market analyses for business segment strategies. He is the author of diverse publications and a popular conference speaker.

Trends in Down Under

Overview of the mining industry in Australia

Summary: Australia's economic development is remarkably positive in comparison to other OECD countries. The mining industry, characterised by the exploitation of coal, iron ore, gold and diamonds as well as such base metals as copper, plays a leading role in this development. In Australia the world's biggest mining companies are active: BHP Billiton, Rio Tinto, Xstrata, Anglo American, Vale, Barrick Gold and many others. What is special about Australia, who are the most important mining companies, how are mineral production figures developing and what export results are achieved? The following report provides numerous answers.

1 Mining as an economic factor

Australia has only 22.4 million inhabitants. At the beginning of 2010, the number of persons in employment was 11 million and the per capita income was above US\$ 45 000, which exceeds the average figure in Europe. The country's gross national product puts it in 15th place worldwide. Australia came through the global economic crisis better than any other OECD country. **Fig. 1** shows the development of real economic growth in comparison to other OECD countries. In 2009 Australia was the only country to achieve a significant growth, with 1.3 %. The mining industry made a hefty contribution to this achievement. If the oil and gas sector is counted as part of the mining industry and direct and indirect services and employees are included, its percentage share in the gross national product is 18 %. Moreover, the mining

industry is responsible for the lion's share of Australia's exports.

Fig. 2 shows how mining industry exports have changed in recent years compared to the overall industrial sector. In fiscal year 2008/09 (July 2008 until June 2009) the mining industry headed the export field for the first time. This was primarily due to the enormous Chinese demand for coal, iron ore and other important mineral resources and the associated high price level of these resources on international commodity exchanges. In June 2010, Australia achieved its highest-ever export surplus as a consequence of a 23 % increase in mining product exports in that month. The large mining companies meanwhile also regained their trust in the government after a tax compromise had been reached and a

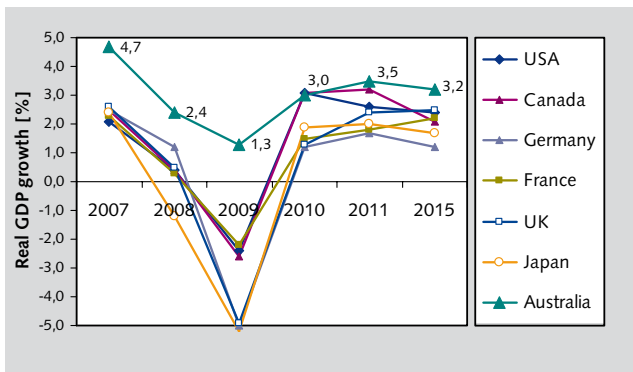


Anderson Port for iron ore (Fortescue)

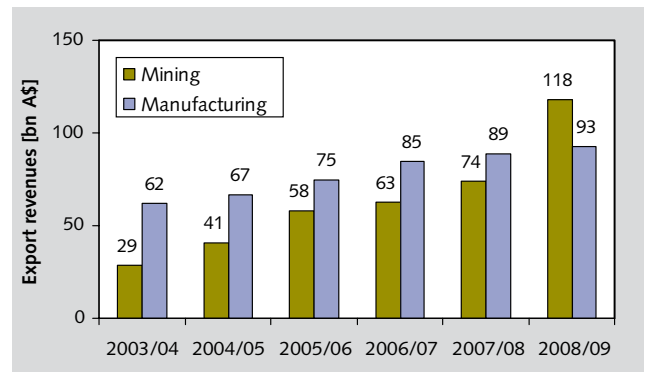
planned special tax on raw materials had been substantially watered down. However, this deprives the public treasury of around 2 billion (bn) Australian dollars (A\$) per year.

Prior to this compromise, the industry and the government had been quarrelling for months about the proposed special tax. The mining companies had protested bitterly against the original tax plans and had threatened to drop investments worth billions of dollars. Projects with a volume of over A\$ 20 bn were put on ice. The Australian Prime Minister

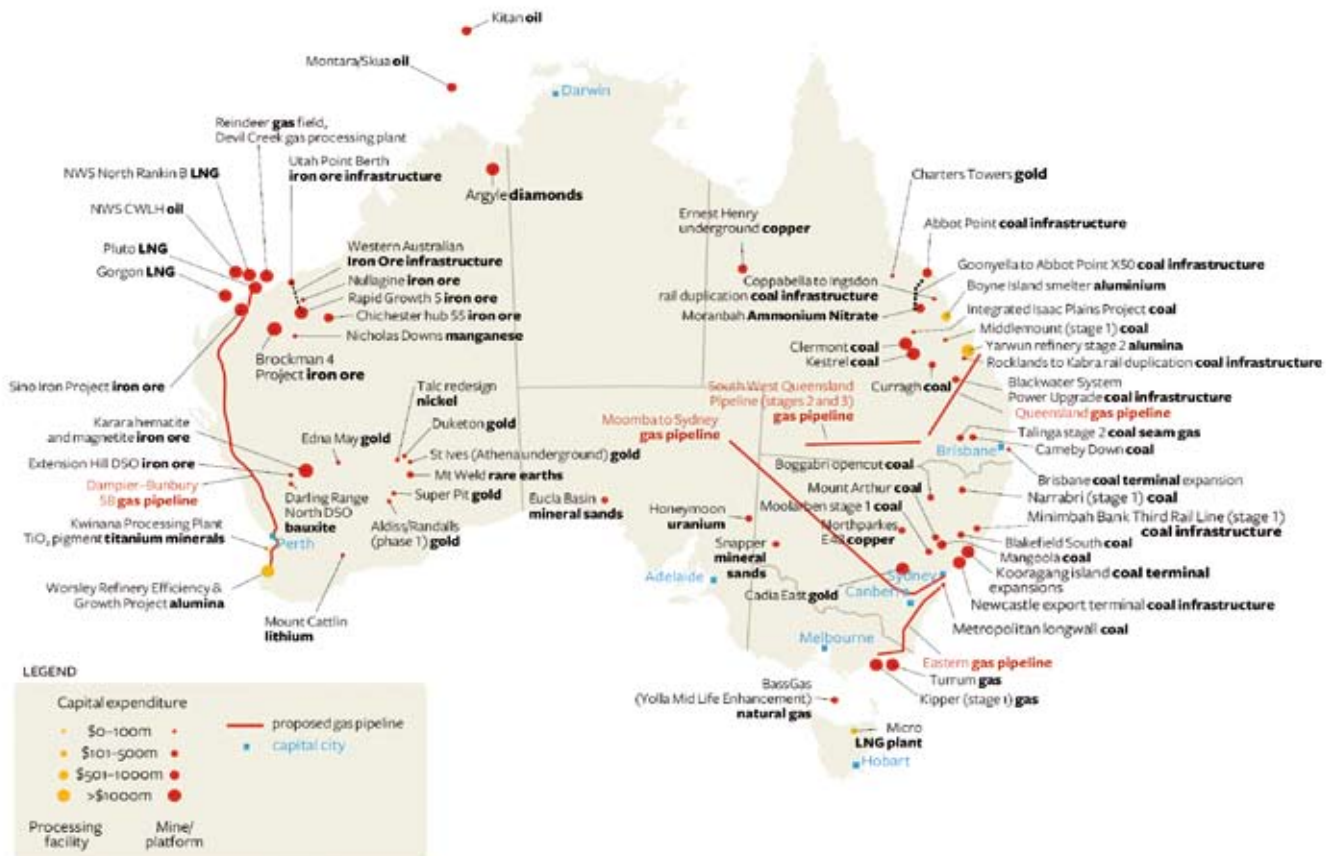
Kevin Rudd had to resign and was replaced by Julia Gillard. Instead of the special tax planned by Rudd for the entire minerals sector, a so-called Minerals Resource Rent Tax of 30 % is to be imposed on coal and iron ore producers. With effect from 2012, this tax will only affect companies that make profits in excess of A\$ 50 m. However, even with this reduced tax rate Australia is at the upper end of the world-wide scale for taxation of mining companies, so it can be assumed that the controversy surrounding the subject of taxation is not yet over.



1 Economic growth of selected OECD countries (IMF)



2 Exports of the Australian mining industry (ABARE)



3 General map of mining projects [1], (ABARE)

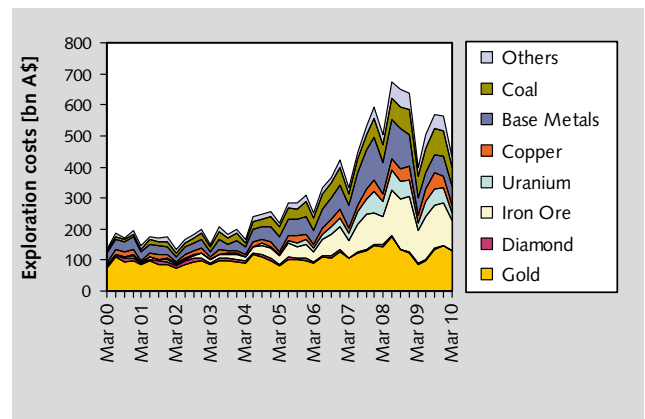
2 Most important mining industry sectors

Australia has a long mining tradition. The exploitation of mineral resources commenced in the south-east region of the country, where British settlers discovered major coal deposits. In 1840, deposits of silver and lead were found in the south of the country. However, it was not until gold was discovered in 1851 in New South Wales and a little later in Victoria that the run to Australia commenced. Australia is richly blessed with mineral resources, possessing the world’s largest reserves of uranium, zinc, nickel, vanadium, tantalum and mineral sands (ilmenite, rutile, zircon). And in the case of other important mineral resources, such as bauxite, coal, iron ore, copper, gold and diamonds, it ranks among the world leaders. The development of new deposits continuously alters the map of Australia. Where mineral resources are discovered, new roads, railway connections, dressing plants and sometimes even entire townships are built in the vicinity.

In the course of time, the most important mineral resources deposits have shifted from the south and south-west regions to Western Australia and Queensland. Currently, the most significant mining areas are the goldfields of the Peel and Pilbara regions in Western Australia, the Bowen Basin in Queensland, the Hunter Valley in New South Wales, the Latrobe Valley in Victoria and various parts of the Outback in the interior of Australia. Nationwide, more than 300 mines are in operation. Fig. 3 presents a general map showing the promising projects that are earmarked for further exploration in 2010. This shows the planned capital costs for developing

the mines and for the beneficiation/processing plants. In addition to projects for coal and metal ore mining, the great importance of projects for oil and gas extraction is obvious. Planned investments in 2009/10 amount to A\$ 41.3 bn after A\$ 38 bn in 2008/09.

Taking the Australian mining industry’s exploration costs as an indicator for the level of investments, it can be seen that these constantly increased in recent years until the global economic crisis occurred. In the fiscal year 2007/08, spending on exploration amounted to A\$ 2.46 bn. In 2008/09, A\$ 2.22 bn was spent. The forecast for 2009/10 is that spending will again increase. Fig. 4 allocates the exploration



4 Allocation of exploration costs to the various minerals (ABARE)

costs to the various minerals (excluding bauxite). The bulk of spending on exploration is taking place on the gold and iron ore sectors. In recent years the exploration costs for uranium, coal and base metals like silver, lead, zinc, nickel, cobalt and copper have also risen steadily. The following sections will deal in more detail with the mining of coal, iron ore, copper and other base metals, gold and diamonds.

2.1 Coal mining

In 2008/09 a total of 438 million tonnes per year (Mta) of raw hard coal was mined, producing 334 Mta of sale coal. A quantity of around 72 Mta went to domestic consumption, while 261.6 Mta were exported. In addition, 73 Mta of lignite was mined. In April 2010, Australian coal mining companies negotiated a price of 98 US\$/t with Japanese power utilities, 40 % higher than the preceding year. This was due to an increase in the Newcastle Spot Price for thermal coal which was largely a consequence of the high demand in China and the 27 % increase of global thermal coal trade in

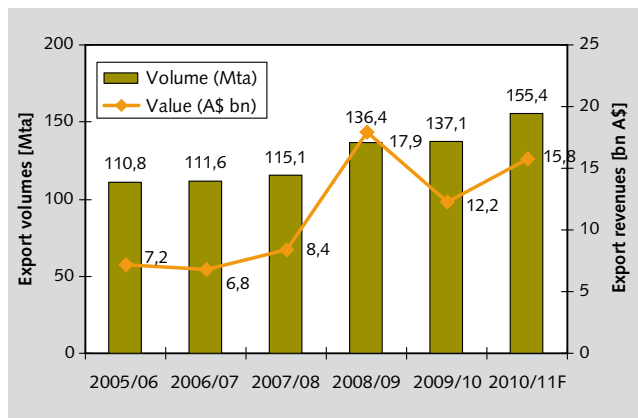
2009 Major Trade flows (Mt) – Met Coal



Source: Trade statistics and BHP Billiton estimates.

5 World trade in metallurgical coal (BHP Billiton)

2009. In the metallurgical coal sector (Fig. 5) Australia achieves with 134 Mta about 2/3 of the global trade. Fig. 6 shows the development of exports of thermal coal for the Australian fiscal years 2006 to 2011 and the earnings thereby achieved. In 2010/11 exports will be increased by 13 % bringing earnings back to almost the same level as in the peak year 2008/09.



6 Exports of thermal coal (ABARE, OneStone)

At present there are about 120 hard coal mines, including 75 open-pit mines. New South Wales has the largest number of mines, followed by Queensland. However, Queensland mines have the largest production quantities. The market is dominated by the 5 producers BHP Billiton, Anglo American, Xstrata, Peabody and Vale with their total market share of approx. 80 %. Other important coal producing companies are Enshan Resources, Mc Arthur Coal, Felix Resources and Rio Tinto. BHP Billiton takes first place with a capacity of over 60 Mta at BMA (BHP Billiton Mitsubishi Alliance) mines. Anglo Coal follows in 2nd place with a capacity of 32 Mta at 8 mines in which they have a majority shareholding. Xstrata owns 17 mines with a capacity of approx. 30 Mta, most of them open-pit mines (Fig. 7). Loy Yang Power is the largest lignite mining firm with a capacity of



7 Excavator in the Bulga coal mine (Xstrata Coal)



8 Longwall excavation machine at Carborough Downs (Vale)

2009 Major Trade Flows (Mt) – Iron Ore



capacity of the Carborough Downs mine has recently been raised to 4.9 Mta by means of a „longwall“ unit (Fig. 8). Rio Tinto’s expansion of the Clermont open-pit mine to 12 Mta is currently the biggest such project. Xstrata is expanding the Mangoola Mine (Anvill Hill) to 9 Mta and is also setting up Moolarben 1 with a capacity of 8 Mta. A further 10 projects that are already at advanced stages in Queensland and New South Wales will add an additional 25 Mta of new capacity. Furthermore, a total of 71 other projects are at the planning stage. As a consequence, coal loading capacities at the country’s harbours are being expanded from the present 330 Mta to over 475 Mta.

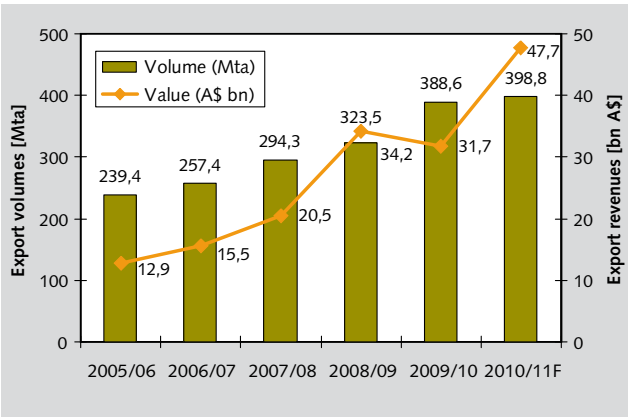
9 World trade in iron ore (BHP Billiton)

approx. 30 Mta. Loy Yang fires the coal in its own power stations in Australia.

The country’s coal resources have a remaining life expectation of about 90 years. Vale is one of the companies that are going to significantly increase production capacities in the coming years. It aims to boost capacity to 40 Mta. The

2.2 Iron ore production

Western Australia dominates the Australian iron ore industry with almost 97 % of the production output. Its Pilbara region holds 86 % of Australia’s iron ore deposits and almost 92 % of the country’s production capacity. Other minor deposits are located in the Northern Territory, South Australia and New South Wales. 353 Mta of iron ore and iron ore concentrate were produced in 2008/09. 323.5 Mta or 92 % of this was exported. In this business year the expected export rate is just under 389 Mta. Fig. 9 depicts the worldwide trade flows for iron ore and illustrates the high level of demand in China and other Asian countries. The development of iron ore export quantities and the achieved earnings are shown in Fig. 10. The new business year is expected to be a record year with an export quantity of almost 400 Mta and planned earnings of A\$ 47.7 bn.



10 Exports of iron ore (ABARE, OneStone)

The three biggest iron ore producers in Australia are Rio Tinto Iron Ore, BHP Billiton and Fortescue Metals. Rio Tinto has a capacity of 220 Mta at 11 different mines in Pilbara. The company has so far shipped more than 3 billion t of iron ore (Fig. 11). 2nd placed BHP Billiton has a capacity of approx. 155 Mta at 7 mining operations in



11 Iron ore shipping in Australia (Rio Tinto)



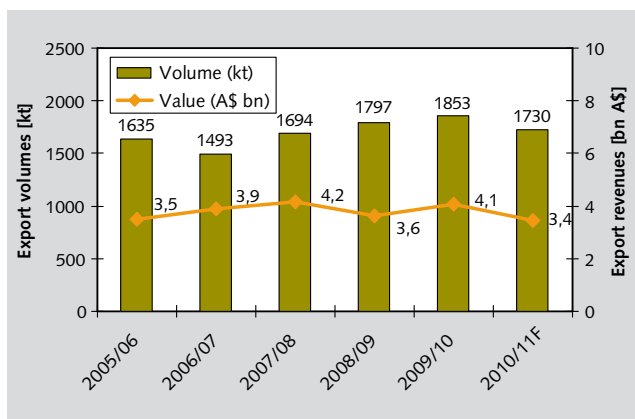
12 Iron ore train from Cloudbreak Mine (Fortescue)



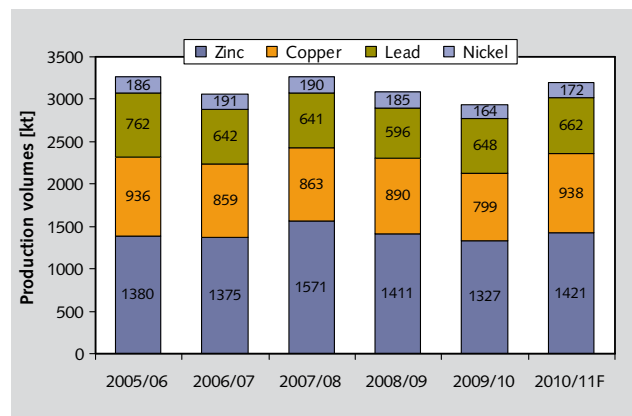
13 Mine development (Citic Pacific Mining)

Pilbara and actually produced 134 Mta in 2009/2010, of which 114 Mta were booked to BHP in accordance with the size of its shareholding. 3rd place in the ranking is taken by Fortescue, who commenced operations at the Cloudbreak open-pit mine (Fig. 12) only two years ago and has now reached a production capacity of 50 Mta. In addition to the above three companies, there is a large number of so-called „junior miners“ like Hancock Prospecting (30 Mta), Portman, Mount Gibson Iron, Extension Hill, Midwest Corporation, Atlas Iron, Gindalbie Metals etc. These junior miners have to overcome the problem of not owning their own railway lines to ports of loading.

Analysts estimate that the iron ore production rate of the Pilbara Region could reach 890 Mta in 2025. Rio Tinto intends to raise its capacity from 220 to 330 Mta by 2016. The company's most important current expansion projects are Mesa A (20 Mta), Brockman 4 (22 Mta) and the 2nd phase of Hope Downs (30 Mta). BHP is also going to further expand its Rapid Growth Project (RGP). RGP 4 should produce an additional 26 Mta, RGP 5 50 Mta and RGP 6 35 Mta. In the long-term view the company is aiming for a capacity of 350 Mta. One of the current showcase projects is Citic Pacific Mining, a Chinese-Australian joint venture. The facility (Fig. 13) is scheduled to come into service later in 2010 with a capacity of 27.6 Mta of iron ore. Most of the equipment was supplied from China. The project's infrastructure includes a 450 MW gas power sta-



15 Exports of copper concentrate (ABARE, OneStone)



14 Production of selected base metals (ABARE, OneStone)

tion, a water desalination unit and a loading terminal at CapePreston.

2.3 Copper and other base metals

Australia possesses the world's largest deposits of the base metals zinc and nickel. Its zinc deposits amount to 53 Mta and account for 27 % of the worldwide reserves. Over 60 % of the deposits are located in Queensland, mainly at the Mount Isa, George Fisher, Century and Dugald River mines. Australia's nickel deposits amount to 25.8 Mta, which is 36 % of the worldwide reserves. Over 90 % of Australian nickel deposits are located in Western Australia. In the case of copper, the country's reserves amount to 120 Mta, of which 78 Mta (65 %) are economically minable from today's point of view. South Australia has deposits containing 55 Mta in the Olympic Dam area. The Queensland deposits account for 11 % of Australia's reserves, while those of New South Wales hold 9 %. Lead reserves amount to 27 Mta with 62 % of the deposits located in Queensland. The country's silver deposits hold 61 000 t.

Fig. 14 shows the quantities of important base metals produced in recent years. In 2009/2010 the largest production quantities will be achieved with zinc (1,327 kilotonnes (kt)), followed by 799 kt of copper, 648 kt of lead and 164 kt of nickel. In this year an 8.5 to 9 % increase in production quantities is expected. All in all, however, there has been little change in the quantities produced.



16 Prominent Hill copper concentrator (OZ Minerals)



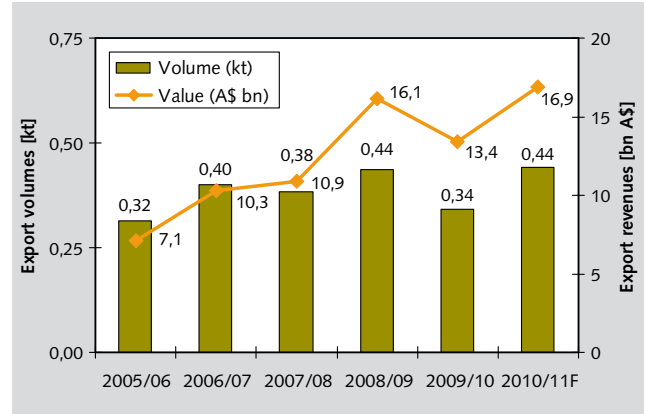
17 Prominent Hill flotation plant (OZ Minerals)

Fig. 15 depicts the export quantities for copper ore and copper concentrate and the earnings thereby achieved. The figure shows that export quantities have only changed insignificantly. The crisis year 2009/10 did not cause a slump – on the contrary, quantities and proceeds increased slightly. No decrease in export quantities is expected until 2010/11.

The most important copper producers in Australia are BHP Billiton, whose biggest production facility is at Olympic Dam, followed by Xstrata with its production facilities Mount Isa and Ernest Henry, OZ Minerals with Prominent Hill, Newcrest Mining with Cadia East and Rideway and Rio Tinto with its Northparkes mine. Prominent Hill (Fig. 16) owns about 75 Mta of minable ore with average contents of 1.19 % copper, 3.01 g/t of silver and 0.59 g/t of gold. Their separation methods include the flotation process (Fig. 17). In the case of nickel, the most important producers BHP Billiton, Norilsk Nickel, Xstrata, Newcrest Mining, Mincor Resources and Western Areas NL account for over 85 % of the market. BHP Billiton is still running the mines of Nickel West subsequent to the closure of the Ravensthorpe mine. Norilsk Nickel owns the Black Swan, Cawse, Lake Johnston and Waterloo mines. In the case of lead, silver and zinc, BHP Billiton and Xstrata are the biggest producers. Xstrata alone operates seven zinc mines in Queensland and the Northern Territory.



19 Grinding system in a beneficiation plant (Newcrest)



18 Gold exports (ABARE, OneStone)

2.4 Gold mining

Second only to China (300 t), Australia’s gold extraction of just under 240 t puts it in front of South Africa and the USA. With its resources of 6,250 t, Australia is again 2nd in the worldwide ranking behind South Africa. At the present mining rate the country’s resources will last another 26 years. Around 60 % of the gold is mined in Western Australia and 15 % in New South Wales. The remaining 25 % is distributed over the other regions, with Victoria, Tasmania and South Australia producing the lowest mining outputs. Fig. 18 shows the export quantities and achieved earnings. The country’s earnings from gold extraction are approximately the same as those from exportation of thermal coal. In 2009/10, gold exports fell significantly due to the global economic crisis and the slump in demand. In 2010/11 exports are expected to reach the level of the pre-crisis years.

Newcrest Mining, Newmont and Barrick Gold are the most important gold producers in Australia. Newcrest (Fig. 19) owns the gold mines Cadia Valley, Cracow, Hidden Valley and Telfer and extracted 1.231 million ounces (oz) of gold in the fiscal year 2009. Newmont owns gold mines in Kalgoorlie, Jundee and Tanami, and operates a 50 % joint venture with Barrick Gold in Boddington (Fig. 20). In 2009 the company produced 1.04 million oz. Barrick Gold owns the Cowall, Kanowa and Plutonic gold mines and operates a joint venture with Newmont in Kalgoorlie (Fig. 21). In the fiscal year



20 Boddington gold extraction plant (Newmont)



21 Boddington Mine beneficiation plant (Newmont)



22 Sunrise Dam beneficiation plant (Anglo Gold Ashanti)

2009, the company extracted 1.006 million oz of gold, of which 0.345 million oz were from its consolidated share in Kalgoorlie. Other important gold producers in Australia include Anglo Gold Ashanti (Fig. 22), Dominion Mining, Citigold and BHP Billiton. Junior miners include Bendigo Mining, Westgold Resources, Castlemain Goldfields, Frontier Resources, the Independence Group, Avoka Resources, Buka Gold, Integra Mining, Ivanhoe Mines and various others.

2.5 The diamond industry

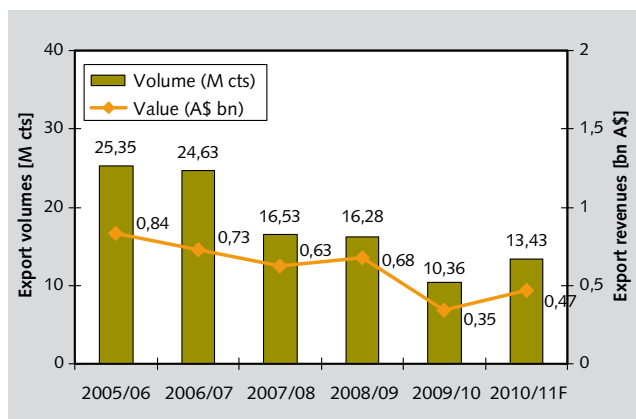
Australia's output of diamonds is the 4th largest worldwide after Russia, the DR Congo and Botswana [2]. In 2009, 15.6 million carats (m cts) were dug (on a volume basis). This is almost 40 % less than in 2005, when the yield was 25.4 m cts. At an average value of 20.04 US\$/carat, a turnover of US\$ 312.7 m was achieved. This turnover is far below those of Russia (US\$ 2.34 bn), Canada (US\$ 1.46 bn), Botswana (US\$ 1.44 bn) and Angola (US\$ 1.18 bn). The largest diamond outputs are achieved by the Argyle and Ellendale mines in Western Australia. Fig. 23 depicts the development of Australian diamond exports in recent years. It shows that up to 2009/10 a practically constant decline in exports occurred. However, it is expected that both production and exports will increase in 2010/11.

Rio Tinto has a 100 % shareholding in the Argyle Mine in Western Australia, 2,200 km north-east of Perth. The first

diamonds were found there in 1979 and the mine has been in operation since 1985. The ore from the 2 km wide and 1 km deep open-pit mine is transported to a dressing plant 2.5 km away (Fig. 24). Up to now, the mine has produced 760 m cts with a peak value of 42.8 m cts in 1994. As the life expectancy of the open-pit mine is now almost over, it was decided in 2001 to develop an underground mine, but this has not yet commenced operations. The Argyle mine still produces almost 98 % of all Australian diamonds. The other 2 % come from the Ellendale Mine (Fig. 25), which belongs to the London company Gem Diamonds. Gem Diamonds took over the Australian Kimberly Diamonds Company in 2007.

3 Prospects

In view of its diverse resources, Australia has an important market-strategic position for the future, thanks to the huge appetite for minerals in Asia and particularly China. All mineral resources that can be economically mined find ready customers in the regional markets. It is therefore not surprising that there are, for instance, plans to double the country's iron ore production capacity and output within the next few years. Billions of dollars are to be invested in coming years in the expansion of mines and beneficiation plants. In the case of iron ore and coal, reserves will be available for relatively long periods of 60 to 100 years. However, in the case of cop-



23 Diamond exports (ABARE, OneStone)



24 Argyle open-pit mine (Rio Tinto Diamonds)



25 Ellendale beneficiation plant (GEM Diamonds)

per, gold and other metals the reserves have a remaining life expectancy of only around 25 years, just about the equivalent of one generation. The next generation and their children and grandchildren will have questions to ask.

Literatur/Literature

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- [2] Harder, J.: Russian's Reserves – Overview of the Mining Industry in Russia. *Aufbereitungstechnik* 51 (2010), No.9, pp.