World Mineral Production

2003–2007

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

BRITISH GEOLOGICAL SURVEY

WORLD MINERAL PRODUCTION 2003–07

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Cover photograph: Zinc ingots produced at Skorpion Mine in southern Namibia. Skorpion began producing zinc in 2003 from a relatively high-grade oxide ore body. Picture: A J Bloodworth BGS © NERC

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PREFACE

This volume is the latest in the series *World Mineral Production*, published by the British Geological Survey. The series that preceded it, comprising *World Mineral Statistics* and *Statistical Summary of the Minerals Industry*, recorded data for every year from 1913.

This publication is compiled from a comprehensive database, maintained by the British Geological Survey, through which we aim to provide a reliable, comprehensive and continuous set of data covering most of the minerals that enter international trade. In this volume we have set out the production figures by country for more than 70 mineral commodities, over the five-year period from 2003 to 2007. We have also included reviews on selected minerals and metals, which provide information on uses, prices, recent production trends and industry events in 2008. The objective of this series remains to present the latest complete production information obtained from official bodies in individual countries, although other sources are also used to ensure completeness and accuracy. The cooperation afforded to the British Geological Survey by numerous national and international organisations is gratefully acknowledged.

While the latter part of 2008 will be remembered for the global economic turmoil that has severely curtailed demand for many commodities, production figures for 2007 actually reveal increases for several minerals and metals: for example, world production of refined copper increased by 21.5 per cent compared to the previous year, chromium ores by 21.2 per cent and primary aluminium by 14.7 per cent. Over the five year period reviewed in this volume some even larger increases can be observed, such as a 65.2 per cent increase in world production of iron ore and a 44 per cent increase in the production of molybdenum.

China continues to dominate the minerals sector and in 2007 was the largest producer of 38 of the commodities included in this volume. Over the five year period 2003 to 2007 there have been substantial increases in China's output of several minerals and metals. For example, Chinese production of refined nickel has increased by more than 200 per cent, natural gas by 98 per cent and perlite by 115 per cent. Other countries have also seen similar increases in production: for example, India's production of bauxite, the main ore of aluminium, has more than doubled in five years and mine production of zinc in Namibia has increased by 95 per cent in the same period.

Security of supply for many mineral commodities is of increasing concern, and information, such as that presented in this volume, is essential to underpin any analysis of global minerals supply trends. Such analysis is critical if adequate mineral supplies are to be maintained, for the benefit of both developed and developing economies around the world.

In addition to our regular publications, the British Geological Survey's database can provide special reports tailored to users' needs. Examples of regional reports include *European Mineral Statistics*, *African Mineral Production, China and South East Asia Production* and *South American Mineral Production*, which are available for free download on the mineralsUK website (www.mineralsUK.com). Commodity reports, including production, exports and imports, can also be prepared to order. The statistics are used in our *Commodity Profile* series, such as the recently produced profile on nickel, and these are also available for free download.

I would welcome any criticisms and suggestions that might help us to meet your changing needs, particularly with respect to the coverage of statistics and the format in which they are made available.

John N Ludden
Executive Director

British Geological Survey
Keyworth
Nottingham

January 2009

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Commodity Index

EXPLANATORY NOTES

Coverage

World Mineral Production covers the majority of economically important mineral commodities. For each commodity constant efforts are made to ensure that as many producing countries as possible are reported. For some commodities, where statistics on production are not publicly available, estimates are made. Users of this compilation are advised that more statistical information than can be included in a publication of this nature is held in the British Geological Survey files and is available for consultation. Historical data (1913-1970) can be obtained from the pre-decessors to this series entitled *World Mineral Statistics* and the *Statistical Summary of the Mineral Industry*.

Arrangement of countries

Countries are ordered alphabetically in geographical groupings as follows:

Europe
Africa
North and Central America, including the Caribbean
South America
Asia
Australasia, including the Pacific Islands

So far as possible the nomenclature follows the London Diplomatic List.

Metals

Mine production of many metals is expressed in terms of metal content. This is clearly indicated at the head of the table, adjacent to the unit used. For aluminium, cobalt, copper, iron, lead, nickel, tin and zinc, mine production and metal production are shown in separate tables. Unless otherwise specified, metal production statistics relate to metal recovered from both domestic and imported materials, whether primary or secondary, but exclude remelted material.

World totals

For certain minerals and metals no world total is shown due to the non-availability of certain individual country totals.

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Acknowledgements

Compilation of this volume of mineral statistics has been possible only by obtaining information from a very large number of organisations throughout the world, chiefly home and overseas government departments and specialist national or international authorities concerned with particular sectors of the minerals or metals industries. To all these bodies the British Geological Survey expresses its grateful acknowledgement for the information made available, whether

in published form or provided by direct correspondence. Particular acknowledgement is made to the Mines Departments and other government agencies of many countries whose regular statements, yearbooks and other reports are worthy of direct consultations by readers in search of detail.

Specialist commodity organisations which have kindly allowed information to be reproduced include the International Copper Study Group, the International Lead and Zinc Study Group, the International Nickel Study Group and the International Fertilizer Industry Association Ltd. In a few instances, information on specific commodities has been obtained directly from company sources. The co-operation of other members of the International Consultative Group on Non-Ferrous Metal Statistics is also gratefully acknowledged.

Supplementary information is also obtained from publications dealing with a wider range of commodities such as Société de l'Industrie Minérale, *Annuaire Statistique Mondial des Minerais et Métaux;* World Bureau of Metal Statistics, *World Metal Statistics* and*, Metallstatistik;* publications of the Interstate Statistical Committee of the CIS, the United States Geological Survey, and UN agencies.

In addition, information has been obtained from the websites of the following organisations, companies, statistical offices and government departments: United Nations; Kaolin & Plastic Clays Europe; International Iron and Steel Institute; Kimberley Process; Eurofer; World Nuclear Association; Organisation of the Petroleum Exporting Countries; Eurostat; European Aggregates Association; South East Asia Iron and Steel Institute; Instituto Latinoamericano del Fierro y el Acero; RNC Gold; Glencairn Gold; Glamis Gold; Goldcorp; Break Water Resources; Inmet Mining; Stillwater Mining; Aluminium de Grece; New Boliden; Eurozinc Mining Corporation; Qatar Steel Company; Institute of Argentinean Petroleum and Gas, Argentina; Institute of Argentinean Steel, Argentina; Northern Territory Government, Australia; Department of Primary Industries Victoria, Australia; Mineral Resources Tasmania, Australia; Australian Bureau of Agricultural & Resource Economics; Vereinigung der Osterreichishen Zementindustrie, Austria; Central Bank of Barbados; Federation de l'Industrie Cimentiere Belge, Belgium; Statistics Belgium; Instituto Nacional de Estatistica Boliva; Cámara Boliviana de Hidrocarburos, Bolivia; Departamento Nacional De Producao Mineral, Brazil; Grupo Paranapanema, Brazil; Agencia Nacional do Petroleo, Brazil; Associação Brasileira do Alumínio, Brazil; Natural Resources Canada; Statistics Canada; Canadian Association of Petroleum Producers; Mineral Resources of Quebec, Canada; Chilean Copper Commission; China Mining Association; Ministerio De Minas Y Energia, Columbia; Unidad de Planeación Minero Energética, Columbia; Oficina Nacional de Estadisticas, Cuba; Czech Republic Statistical Office; Statistics Denmark; Banco Central de la Republica Dominicana, Dominican Republic, Banco Central del Ecuador; Geological Survey of Finland; New Boliden, Finland; Federation des Minerais, Mineraux Industrielles et Metaux non Ferreux, France; Comite Professionel de Petrole, France; Ministere de l'Economie, des Finances et de l'Industrie, France; Unicem, France; Infociments, France; Statistisches Bundesamt Deutschland, Germany; National Statistical Service of Greece; National Bank of Guyana; Ministerio de Energia y Minas, Guatemala; Federacciai, Italy; Unione Petrolifera, Italy; Istituto Nazionale di Statistica, Italy; Salt Industry Centre, Japan; Korea Institute of Geoscience and Mineral Resources, Republic of Korea; Statec, Luxembourg; Bank Negara Malaysia; Pemex, Mexico; Secteria de Economia, Mexico; Servicio Geologico de Mexico; Statistics Office of Montenegro; Centraal Bureau voor de Statistiek, Netherlands; Staatstoezicht op de Mijnen, Netherlands; Ministry of Economic Development, New Zealand; Central Bank, Nicaragua; Statistisk Sentralbyra, Norway; Ministry of National Economy, Oman; Direccion de Estadistica y Censo, Panama; Chamber of Mines and Petroleum, Papua New Guinea; PeruPetro; Ministerio de Energia y Minas, Peru; Sociedad Nacional de Mineria Petroleo y Energia, Peru; Mines and Geosciences Bureau, Philippines; Instituto Nacional de Estatistica, Portugal; Statistical Office of the Republic of Serbia; Unesid, Spain; Rio Narcea, Spain; Lundin Mining; Spain; Staatsolie Maatschappij, Suriname; Sveriges Geologiska Undersokning, Sweden; Jernkontoret, Sweden; Statistiska Centralbyran, Sweden; Bank of Thailand; Central Bank of Trinidad and Tobago; Department of Business, Enterprise and Regulatory Reform, United Kingdom; Office for National Statistics, United Kingdom; Energy Information Administration, United States of America; Direccion Nacional de Minería y Geología, Uruguay; General Statistics Office, Vietnam; Central Statistical Organisation, Republic of Yemen.

Units

The Statistics shown in this volume are expressed in metric units. The following factors are given for converting to non-metric units:

tonnes × 0.9842 = long tons
tonnes × 1.1023 = short tons
kilograms × 2.2046 = pounds
kilograms × 32.1507 = troy ounces
cubic metres × 35.3147 = cubic feet
1 tonne of crude petroleum equals on average 7 barrels of crude petroleum.
1 flask mercury = 34.5 kilograms
1 metric ton unit = 10 kilograms

Symbols

...	figures not available
0	quantity less than half unit shown
—	nil
*	estimated
BGS	British Geological Survey
c.i.f	Cost, Insurance, and Freight. The seller's price includes the cost of the goods, the insurance of the goods to their destination port, and the cost of freight.
f.o.b.	Free On Board. The seller is responsible for the costs of delivering goods to the ship. The buyer is responsible for transportation and insurance costs from that point.
TWh	Terawatt hours (1 TWh = 1 thousand million kilowatt hours)

STATISTICAL INFORMATION

BAUXITE – ALUMINA – ALUMINIUM

Characteristics

Bauxite, the most common ore of aluminium, is a hard, reddish, clay-like material. It was first discovered near the village of Les Baux in southern France. Bauxite occurs in three main forms: gibbsite (aluminium hydroxide), böhmite and diaspore (both aluminium-oxide-hydroxides). Gibbsite is the dominant form mined. Bauxite is a residual type of ore deposit that has been left on the land surface following intense weathering and the removal by leaching of other minerals. Consequently, it tends to occur mainly in tropical and sub-tropical regions such as the Caribbean, parts of Africa, South America, and Australia. The largest reserves of bauxite are in Guinea (7400 million tonnes), Australia (5800 million tonnes) and Jamaica (2000 million tonnes) (Bray, 2008).

Alumina (aluminium oxide) is a white granular material produced from bauxite by the Bayer refining process, which involves dissolving the bauxite in caustic soda at high temperature and pressure. Aluminium hydroxide is then precipitated from the liquid and this is calcined to form aluminium oxide powder.

Aluminium metal is produced by the electrolysis of alumina dissolved in a molten salt in a smelter. This process is a very large consumer of electrical power and as a consequence the availability of cheap electricity tends to determine the location of aluminium smelters.

Pure aluminium is a silver-white metal with many desirable characteristics. It is light, non-toxic, non-magnetic and non-sparking. It is easily formed, machined or cast, and forms alloys with many other metals such as copper, magnesium, and silicon. Aluminium and most of its alloys are highly resistant to corrosion. It is also a very good conductor of electricity (IAI, 2007).

Uses

Bauxite is primarily used to produce alumina through the Bayer process. However, between five and 15 per cent of bauxite is of non-metallurgical grade and most of this is calcined into 'brown fused alumina' for use in the abrasive or refractory markets.

Approximately 90 per cent of alumina produced in the world is used in the production of aluminium metal through smelting. Some of the remaining 10 per cent is calcined at higher temperatures than smelter grade alumina and is used for a wide range of refractory and ceramic purposes. Fused alumina is formed in electric arc furnaces at high temperatures and is used in the manufacture of abrasives and refractories (Tran, 2007a).

Aluminium is, in terms of tonnage, the most widely used non-ferrous metal. It is used extensively in the transport manufacturing industry (most importantly in the aerospace industry but also in road vehicles, trains and ships), packaging (cans, foil), water treatment, construction (windows, doors, wire), cooking utensils, electrical transmission lines, electronics, CDs and transistors. It is also used in paints and rocket fuel. In most uses it is alloyed with small amounts of other metals such as magnesium and manganese. Recycling is an important feature of aluminium use and recycled metal (including manufacturing scrap) contributes about 39 per cent of consumption.

World production in 2007

Australia mined the most bauxite in 2007, extracting 29 per cent of the world total. Production here has increased by 12 per cent since 2003. The second largest is Brazil, with 12 per cent, closely followed by China, with an estimated 11 per cent and India with 10 per cent. China's bauxite production has risen by 48 per cent since 2003 (although it remains heavily dependent on bauxite imports), whereas India's production has more than doubled over the same period.

The traditionally large producing countries of Guinea and Jamaica both remained relatively static in 2007 and show only modest growth of eight per cent each over the five-year period. This has dropped Guinea to the fifth largest producer in the world and Jamaica to seventh. The sixth largest producer is now Indonesia where production is estimated to have increased dramatically in recent years (based on reported imports to other countries). Significant increases in production have also been recorded in Malaysia, Pakistan, Vietnam, Turkey, Ghana and Bosnia & Herzegovina although each of these supplies less than one per cent of the world total.

In 2007 China overtook Australia as the world's largest producer of alumina, producing 25 per cent of the total compared to Australia's 24 per cent. China's production has increased by more than 200 per cent since 2003 while Australia's output has only increased by 14 per cent. Other major producers are Brazil, with nine per cent of the world's total; the USA, and Jamaica, with five per cent each. Brazil's output has increased by 50 per cent between 2003 and 2007 while the USA's production has decreased by 20 per cent over the same period.

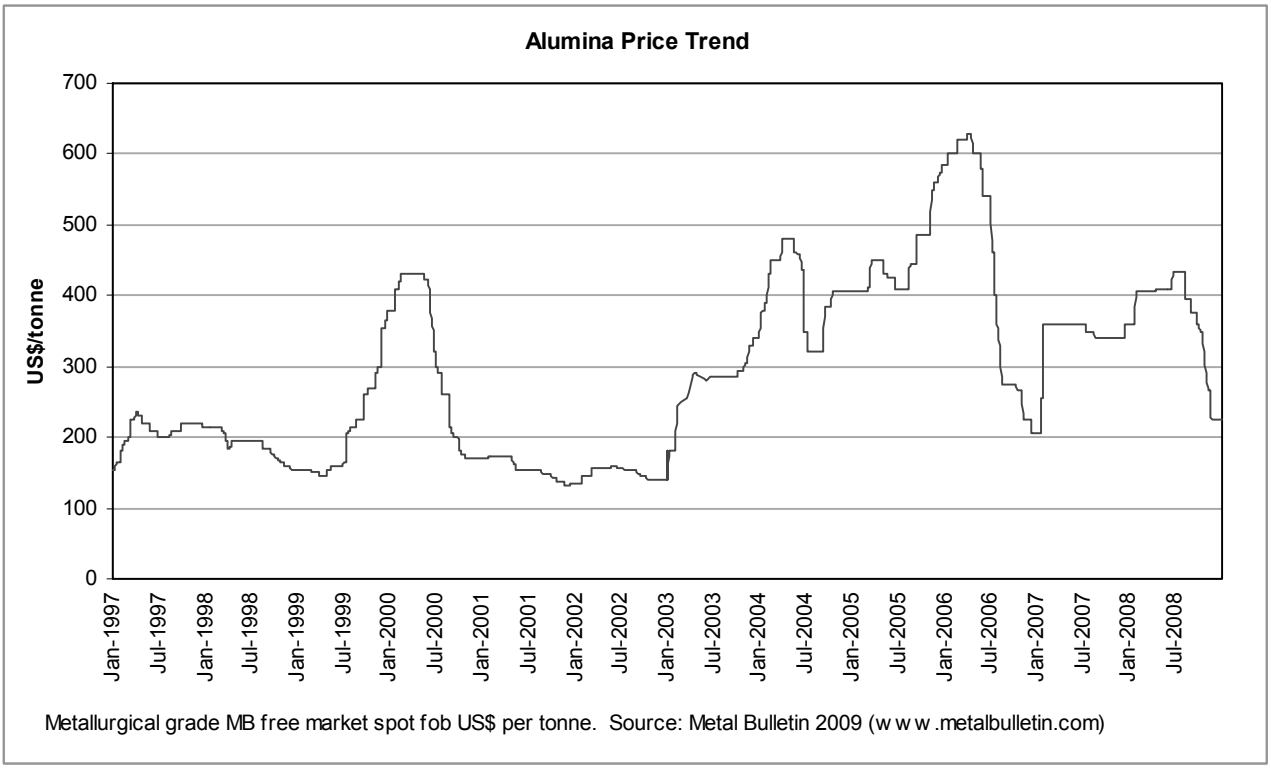
The world's largest aluminium metal producer is China, with 33 per cent of the world total. The next biggest producers are Russia, with 10 per cent, and Canada, with eight per cent. China's aluminium production has increased by 126 per cent since 2003. Iceland's production increased further in 2007 with the opening of the new Alcoa smelter on the eastern fjords. Output in Iceland has increased by 56 per cent since 2003. Other significant increases over this period occurred in Azerbaijan (111 per cent), Bahrain (65 per cent), Dubai (59 per cent), India (52 per cent) and Romania (51 per cent).

Prices

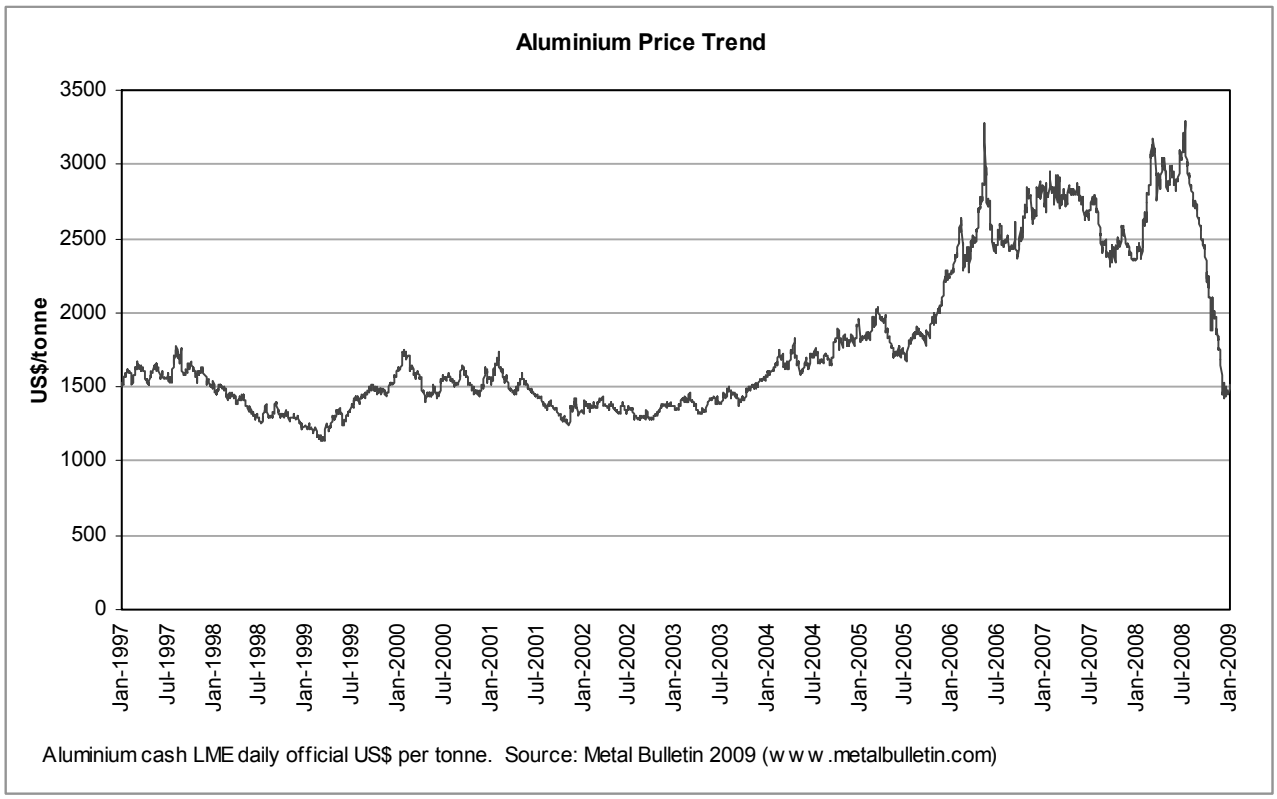
Metallurgical grade bauxite is mostly traded on long-term contracts and typical prices are not published. During 2008, prices for many commodities increased, including non-metallurgical bauxite. By August, Chinese calcined bauxite generally traded in the range US$550 to US$650 per tonne, with Guyanan calcined bauxite slightly higher (Dickson, 2008). However, as with metallurgical grade alumina and aluminium, these are likely to have fallen more recently.

Spot prices for metallurgical grade alumina increased during the first seven months of 2008 reaching a high of US$420 to US$450 by early August. Since then, however, there has been a sharp decline to US$210 to US$240 by year end (Metal Bulletin online, 2008).

The London Metal Exchange official daily cash price for aluminium ingot showed a sharp increase in the early part of 2008, reaching a high of just over US$3100 per tonne by the end of March before dropping back slightly. It remained at similar levels until June, peaked at US$3200 per tonne in early



Metallurgical grade MB free market spot fob US$ per tonne. Source: Metal Bulletin 2009 (w w w .metalbulletin.com)



Aluminium cash LME daily official US$ per tonne. Source: Metal Bulletin 2009 (w w w .metalbulletin.com)

July but has since fallen dramatically to less than US$1500 per tonne by the end of the year (Metal Bulletin online, 2008).

The increases in both alumina and aluminium in early 2008 were as a result of production shortfalls following bad weather in China and power problems elsewhere. The global economic crisis in the latter part of 2008 has caused a sharp decline in demand for many commodities, including aluminium, and the sharp decline in prices shown here is a direct result.

Industry events in 2008

Although the news towards the end of 2008 was dominated by the fallout following the 'credit crunch', the majority of the year saw several organisations planning increases in output of bauxite, alumina and aluminium with both expansions and new plants being proposed.

With regards to bauxite, Rio Tinto moved closer to developing an extension to the south of their existing Weipa Mine in Queensland, Australia after approving a feasibility study

(Mining News, 2008a) and Vedanta Resources were delighted to receive Supreme Court approval for their controversial plan for a bauxite mine in the Indian state of Orissa (Dixon, 2008).

Aluminium Corp of China (Chalco) plans to double production of bauxite in order to increase its self-sufficiency and reduce costs (Mining Journal, 2008a), while further expansion of the Paragominas bauxite mine in Brazil was reportedly approved by Vale's Board of Directors to increase capacity to more than 14 million tonnes per year by 2011 (Kosich, 2008a)

For alumina, Guangxi Huayin Aluminium Corp started production at their 400 000 tonnes per year plant in China (Metal Bulletin, 2008a); UC Rusal established a strategic partnership with China Power Investment Corp to build a 2.8 million tonnes per year refinery in Guinea (Metal Bulletin, 2008b); and Rio Tinto commenced expansion of their Yarwun alumina refinery in Queensland which could see the plant's output double by 2011 (Dudley, 2008a).

Yunnan Aluminium started construction of a new alumina refinery in Wenshan, China in June, with commission of the 800 000 tonnes per year plant planned for the end of 2009 (Metal Bulletin, 2008g) and Vale approved the construction of a new 1.8 million tonnes per year refinery just five kilometres away from the largest refinery in the world at Alunorte in Brazil (Kosich, 2008a).

With regards to aluminium, UC Rusal completed two new potlines at its Irkutsk aluminium smelter in Russia. An investment that cost an estimated US$600 million and is expected to increase output by 55 per cent (Lovesey, 2008a). In addition there were plans to build new smelters in Libya (Metal Bulletin, 2008c), Sarawak Malaysia (Mining News, 2008b), and at Richards Bay in South Africa where India's National Aluminium Co (Nalco) also plan to build a captive coal power station (Metal Bulletin, 2008d). In addition, Nalco plans to invest in a new smelter and power plant in Indonesia plus another smelter in Iran, with further expansion expected in India (Metal Bulletin, 2008f).

A new aluminium smelter is under construction in Azerbaijan, at a cost of US$230 million which will double the country's output when production starts by the end of 2009 (Metal Bulletin, 2008e). UC Rusal has also reopened its aluminium smelter in Nigeria which had been idle since 2000 (Mukumbira, 2008), and Vedanta has started trial production at its 250 000 tonnes per year smelter in the state of Orissa, India, making it the largest aluminium producer in India (Nair, 2008). Another smelter is under construction in Boguchanskoye, Russia, for US Rusal with completion of the 600 000 tonnes per year plant expected in 2010 (Mining Journal, 2008b).

Sohar Aluminium commenced production at its 300 000 tonnes per year aluminium smelter in Oman during mid 2008 making it the first new smelter in the Persian Gulf for 25 years (Metal Bulltin, 2008h).

However, it was not all good news during the first part of 2008 with power supply shortfalls in South Africa causing aluminium production cutbacks and at least one reassessment of a proposed new smelter (Dudley, 2008b; Metal Bulletin, 2008i). Snowstorms in China in January restricted supplies of coal to power plants and consequently forced the shut down of nearby aluminium smelters. It took several months for production to be restored and required the intervention of the Chinese army to assist with reconstruction work (Metal Bulletin, 2008j and 2008k).

Poor weather of a different kind caused problems for Rio Tinto's Tiwai Point aluminium smelter in New Zealand where lack of rainfall restricted hydro-power supplies for part of the year causing production to be cut back by 10 per cent (Metal Bulletin, 2008l; Mining Journal, 2008c). Alumina and aluminium supplies were also affected by the Varanus Island gas explosion in Australia, which reduced gas supplies in the region by 30 per cent (Haycock, 2008) and a fire in a substation at Anglesey Aluminium in the United Kingdom caused production at the plant to be reduced (Metal Bulletin, 2008m).

The Sichuan earthquake in May, delayed the start up of the Aba Aluminium smelter which is located near the epicentre. However, damage to the plant was described as 'not severe' and commissioning of the 100 000 tonnes per year plant may delayed by only a year (Metal Bulletin, 2008g).

Market conditions towards the end of the year, caused to large extent by the global economic crisis, has had a number of significant impacts including the closure of an aluminium smelter in Texus (Kosich, 2008b), major reductions in output from alumina plants at Shandong in China (Yam, 2008) and Point Comfort in the USA (Dudley, 2008c), and the delay in construction of an aluminium smelter in Saudi Arabia (Metal Bulletin, 2008n). Norsk Hydro shelved plans for a new aluminium production line at Karmoy and decided to close its 120 000 tonnes per year soderberg potlines earlier than expected (Metal Bulletin, 2008o).

In general the sharp drop in prices and decreasing demand during the latter part of the year meant that most aluminium producers were finding it difficult to operate at a profit and were implementing cutbacks in output (Metal Bulletin, 2008n; Lovesey, 2008b; Regan, 2008; Mason, 2008; Welch, 2008). 2009 could be a difficult year.

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Production of bauxite

tonnes

Country	2003	2004	2005	2006	2007
Bosnia & Herzegovina	573 000	916 900	1 031 600	854 047	800 546
France	170 000	170 000	175 000	160 000	*160 000
Greece	2 418 000	2 396 065	2 441 443	2 162 900	*2 220 000
Hungary	665 904	646 726	535 337	507 259	515 061
Montenegro	—	—	—	659 370	667 053
Russia	5 441 800	6 017 600	6 409 300	6 399 200	6 053 900
Serbia and Montenegro	540 051	610 000	672 345	—	—
Turkey	364 306	365 836	356 480	771 227	863 404
Ghana	494 716	498 060	606 700	841 775	1 033 368
Guinea	17 072 200	18 795 500	19 237 300	18 184 000	18 519 010
Mozambique	11 793	6 723	9 518	11 069	11 800
Sierra Leone	—	—	—	1 071 140	1 169 036
Tanzania	...	...	1 640	5 373	5 003
Jamaica	13 444 528	13 296 481	14 116 393	14 865 351	14 567 738
USA (b)	251 633	259 870	121 187	361 047	128 742
Brazil (c)	18 456 800	20 511 800	22 364 600	23 236 300	25 460 700
Guyana	1 712 236	1 478 897	1 694 126	1 478 670	2 248 928
Suriname	4 215 061	4 087 107	4 756 998	4 945 353	5 273 195
Venezuela	5 445 516	5 814 705	5 900 000	5 928 000	*5 000 000
China	14 567 000	17 518 000	17 408 200	18 981 600	*21 600 000
India (d)	10 924 786	11 964 011	12 595 803	15 661 220	22 999 000
Indonesia	1 262 705	1 330 827	*2 700 000	*9 000 000	*16 000 000
Iran (a)	391 388	420 000	437 595	*440 000	*500 000
Kazakhstan	4 737 100	4 705 400	4 815 400	4 883 800	4 962 600
Malaysia	5 732	2 040	4 735	91 806	156 785
Pakistan (e)	4 098	4 847	6 504	7 831	18 082
Vietnam	*20 000	*20 000	55 000	60 000	*80 000
Australia	55 602 000	56 593 000	59 959 000	61 781 000	62 428 000
World Total	159 000 000	168 000 000	178 000 000	193 000 000	213 000 000

Note(s):-
(1) This table includes production of refractory bauxite

(a) Years ended 20 March following that stated
(b) Data for Alabama only
(c) Including beneficiated and direct shipping ore
(d) Years ended 31 March following that stated
(e) Years ended 30 June of that stated

Production of alumina

tonnes (Al_2O_3 content)

Country	2003	2004	2005	2006	2007
Azerbaijan	179 995	232 300	314 764	362 665	184 500
Bosnia & Herzegovina	35 011	356 844	447 260	393 580	303 799
France	*600 000	*600 000	*600 000	*636 000	*500 000
Germany	*830 000	*835 000	*830 000	*850 000	*1 000 000
Greece	496 000	514 000	511 000	510 000	516 000
Hungary	300 000	304 000	300 000	300 000	*300 000
Ireland, Republic of	1 500 000	*1 500 000	*1 800 000	1 800 000	1 800 000
Italy	1 021 000	1 064 000	1 070 000	1 090 000	1 100 000
Montenegro	—	—	—	236 740	240 186
Romania	332 853	560 243	689 329	622 083	23 097
Russia	3 230 478	3 269 416	3 259 216	3 265 216	3 332 308
Serbia and Montenegro	239 739	245 005	235 196	—	—
Spain	1 380 000	*1 400 000	*1 400 000	*1 400 000	1 450 000
Turkey	160 675	169 991	112 558	150 117	163 435
Ukraine	1 434 050	1 562 970	1 632 020	1 671 620	1 655 718
Guinea	723 026	778 000	722 400	555 000	542 073
Canada	1 269 600	1 328 842	1 400 340	1 476 959	1 454 390
Jamaica	3 843 610	4 022 722	4 085 634	4 099 548	3 940 589
USA	4 861 000	5 354 000	5 215 000	4 696 000	3 890 000
Brazil	4 713 800	5 126 500	5 191 100	6 735 000	7 077 600
Suriname	2 004 538	2 014 622	1 939 615	2 151 148	2 178 472
Venezuela	1 882 007	*1 900 000	1 931 000	1 920 000	*1 800 000
China	6 112 100	6 980 000	8 592 200	13 256 900	19 453 000
India	2 856 000	2 974 000	3 066 000	3 077 000	3 208 000
Iran (a)	102 785	137 002	130 100	*130 000	*130 000
Japan	725 000	780 000	*780 000	*780 000	*780 000
Kazakhstan	1 419 237	1 467 966	1 505 415	1 514 509	1 544 462
Australia	16 529 000	16 700 000	17 704 000	18 312 000	18 884 000
World Total	58 800 000	62 200 000	65 500 000	72 000 000	77 500 000

Note(s):-
(1) Where possible figures in this table show the alumina equivalent (Al_2O_3) of total hydrate produced, whether or not calcined

(a) Years ended 20 March following that stated

Production of primary aluminium

tonnes

Country	2003	2004	2005	2006	2007
Azerbaijan	18 565	29 537	31 762	31 852	39 241
Bosnia & Herzegovina	112 500	121 294	131 094	136 190	147 193
France	444 000	447 000	440 000	442 879	430 159
Germany	660 783	667 800	647 900	515 539	551 030
Greece	167 797	166 634	165 300	165 000	168 000
Hungary	35 000	34 400	31 000	300	—
Iceland	286 022	284 700	273 318	328 424	446 297
Italy	191 400	195 400	192 900	194 200	179 500
Montenegro	—	—	—	121 762	135 151
Netherlands	282 800	330 000	333 820	285 317	296 900
Norway	1 180 200	1 318 000	1 391 000	1 383 000	1 362 000
Poland	57 145	58 931	54 508	57 620	58 736
Romania	196 844	222 347	258 000	277 382	297 940
Russia	3 478 057	3 594 747	3 647 061	3 117 249	3 955 417
Serbia and Montenegro	116 744	115 080	116 994	—	—
Slovakia	132 089	156 893	158 400	158 289	190 237
Slovenia	109 800	120 700	120 642	118 682	111 016
Spain	389 100	397 500	395 000	367 400	405 100
Sweden	100 707	100 591	102 107	101 668	99 842
Switzerland	43 865	44 879	44 800	12 000	—
Turkey	63 140	64 002	59 000	60 000	63 400
Ukraine	113 640	113 212	114 213	112 952	113 437
United Kingdom	342 748	359 631	368 477	360 325	364 595
Cameroon	78 800	85 900	86 400	88 400	87 000
Egypt	194 600	216 000	243 800	252 300	258 300
Ghana	15 909	—	13 400	75 800	12 900
Mozambique	407 400	547 100	553 700	564 000	559 900
South Africa	732 717	866 074	846 213	895 000	899 000
Canada	2 791 915	2 592 160	2 894 204	3 051 128	3 082 625
Mexico	17 600	—	—	—	—
USA	2 703 300	2 516 400	2 481 000	2 283 800	2 554 000
Argentina	273 524	273 575	275 071	277 800	292 700
Brazil	1 380 600	1 457 400	1 497 600	1 604 500	1 654 800
Venezuela	601 290	631 100	624 000	617 100	615 700
Bahrain	526 000	530 000	749 987	872 393	865 883
China	5 546 900	6 688 800	7 806 000	9 358 400	12 558 600
Dubai	560 000	683 000	724 565	789 341	889 548
India (b)	810 282	883 960	930 543	1 113 849	*1 230 000
Indonesia	197 300	240 800	252 300	250 300	*242 400
Iran (a)	182 477	212 602	218 754	*205 000	*204 000
Japan	6 463	6 433	6 400	6 500	6 600
Tajikistan	319 360	358 082	379 630	413 800	419 060
Australia	1 857 000	1 895 000	1 903 000	1 929 000	1 957 000
New Zealand	334 970	350 299	351 449	337 300	353 000
World Total	28 100 000	30 000 000	31 900 000	33 300 000	38 200 000

Note(s):-
(a) Years ended 20 March following that stated
(b) Years ended 31 March following that stated

Mine production of antimony

tonnes (metal content)

Country	2003	2004	2005	2006	2007
Russia	*3 000	*3 000	*3 000	*3 000	*3 000
Turkey	*400	*700	*1 200	*1 200	*1 500
South Africa	5 291	4 967	5 979	*4 500	*3 500
Canada	153	105	79	269	241
Guatemala	2 000	2 686	1 007	*1 000	*1 000
Mexico	434	503	565	778	414
Bolivia	2 432	3 036	5 204	5 460	3 881
Peru (a)	616	465	807	691	590
China	100 000	125 433	151 457	156 200	152 900
Kyrgyzstan	*1 200	*1 500	*1 500	*1 500	*1 500
Pakistan (b)	...	—	5	91	119
Tajikistan	*3 000	4 069	4 073	3 480	*3 500
Thailand	46	61	415	1 639	—
Australia (b)	900	157	192	1 600	*2 000
World Total	119 000	147 000	175 000	181 000	174 000

Note(s):-
(1) This table includes antimony content of antimonial lead alloys
(2) In addition, Hungary is believed to produce antimony

(a) Including Sb content of antimonial lead plus Sb content of ores for export
(b) Years ended 30 June of that stated

Production of white arsenic

tonnes

Country	2003	2004	2005	2006	2007
Belgium	*1 000	*1 000	*1 000	*1 000	*1 000
Portugal	*25	*15	*15	*15	*15
Russia	*1 500	*1 500	*1 500	*1 500	*1 500
Namibia (a)	389	1 264	29	—	—
Canada	*250	*250	*250	*250	*250
Mexico	2 283	2 415	2 197	2 106	677
Bolivia	276	168	120	120	*120
Chile (c)	*10 000	*10 000	*10 000	*10 000	*10 000
Peru	4 640	3 037	3 150	4 399	4 321
China	*40 000	*30 000	*30 000	*30 000	*25 000
Iran (b)	275	89	*100	*100	*100
Japan	*40	*40	*40	*40	*40
Kazakhstan	*1 500	*1 500	*1 500	*1 500	*1 500

Note(s):-
(1) This table includes calculated trioxide equivalent of arsenic metal produced except where this would involve double counting
(2) In addition to the countries listed, Austria, Finland, Hungary, Spain and the United Kingdom are believed to produce arsenic

(a) Trioxide equivalent of reported black arsenic
(b) Orpiment and realgar concentrates
(c) Exports

Production of asbestos

tonnes

Country	2003	2004	2005	2006	2007
Greece	*13 000	*4 000	—	—	—
Russia	883 888	923 000	*925 000	*925 000	*925 000
Serbia	—	—	—	157	160
Serbia and Montenegro	111	370	*100	—	—
South Africa					
Chrysotile	6 218	—	—	—	—
Zimbabwe					
Chrysotile	143 087	104 457	122 041	96 956	*97 000
Canada					
Chrysotile	200 500	220 000	*186 000	*185 000	*185 000
Argentina	166	267	260	299	300
Brazil	231 115	252 067	236 047	227 304	254 204
Colombia (c)	*60 000	*60 000	*60 000	*60 000	*60 000
China	*430 000	438 962	332 407	458 000	*460 000
India					
Amphibole (a)	10 107	6 392	2 323	415	261
Iran (d)	1 470	1 300	1 300	*1 300	*1 400
Kazakhstan	353 000	346 500	305 500	314 700	292 600
Pakistan (b)	60	380	—	—	—
World Total	2 300 000	2 400 000	2 200 000	2 300 000	2 300 000

Note(s):-
(1) In addition to the countries listed, Romania is believed to produce asbestos

(a) Years ended 31 March following that stated
(b) Years ended 30 June of that stated
(c) Crude
(d) Years ended 20 March following that stated

Production of barytes

tonnes

Country	2003	2004	2005	2006	2007
Bosnia & Herzegovina	386	63	160	190	37
Bulgaria	91 200	75 400	76 600	74 500	50 900
France	81 100	81 000	*81 000	*40 000	—
Germany	109 506	93 624	88 591	85 524	88 265
Italy	12 214	12 258	7 312	*7 000	*7 000
Poland	3 030	3 183	2 357	2 034	*2 000
Russia	79 000	63 400	63 400	63 000	64 000
Slovakia	12 000	25 000	26 589	57 000	58 000
Spain	44 660	40 776	42 792	45 001	20 000
Turkey	119 648	134 504	157 200	160 000	150 000
United Kingdom	*57 000	*61 000	*64 000	*48 000	*53 000
Algeria	47 340	47 753	54 773	64 787	63 098
Morocco	358 496	511 800	597 600	628 400	664 700
Nigeria	*15 000	*15 000	*30 000	30 011	*30 000
Tunisia	2 600	1 813	—	—	—
Zimbabwe	4 676	3 486	—	—	—
Canada	27 000	21 000	23 000	21 000	40 000
Mexico	287 451	306 668	268 657	199 605	185 921
USA (b)	468 000	532 000	489 000	598 000	*540 000
Argentina	6 934	2 762	3 355	6 276	*6 000
Bolivia	1 851	5 774	11 379	8 943	8 245
Brazil (d)	57 452	50 430	42 924	47 611	37 000
Chile	229	31	91	375	77
Colombia	*2 400	*2 000	*2 000	*2 000	*2 000
Ecuador	2 139	3 694	3 879	*4 000	*4 000
Peru	2 906	9 610	26 985	1 899	27 369
Afghanistan	*2 000	*2 000	*1 500	*1 500	*1 500
Burma	4 900	2 200	2 100	2 900	2 500
China	3 300 000	3 700 000	4 100 000	4 600 000	4 300 000
India (a)	723 075	1 159 031	1 156 227	1 730 803	999 497
Iran (c)	196 169	207 466	231 184	226 032	*226 000
Kazakhstan	78 000	310 700	268 700	261 100	280 300
Laos	18 070	10 470	28 500	29 000	29 000
Malaysia	—	—	—	910	—
Pakistan (e)	40 745	44 071	42 087	44 183	46 155
Saudi Arabia	10 800	30 000	30 000	23 308	...
Thailand	115 600	211 278	3 989	4 549	8 631
Vietnam	81 500	101 000	116 000	90 000	90 000
Australia	*22 000	*29 000	18 020	*18 000	*13 500
World Total	6 500 000	7 900 000	8 100 000	9 100 000	8 100 000

Note(s):-
(1) This table may include small quantities of witherite
(2) In addition to the countries listed, Cuba is believed to produce barytes

(a) Years ended 31 March following that stated
(b) Sold or used by producers
(c) Years ended 20 March following that stated
(d) Including beneficiated and directly shipped material
(e) Years ended 30 June of that stated

Production of bentonite and fuller's earth

tonnes

Country	2003	2004	2005	2006	2007
Armenia					
Bentonite	642	561	732	720	1 129
Azerbaijan					
Bentonite	19 900	55 000	53 700	40 600	50 500
Bosnia & Herzegovina					
Bentonite	16 967	24 353	24 882	24 645	32 338
Bulgaria					
Bentonite	145 500	224 900	181 200	134 500	99 000
Croatia					
Bentonite	13 568	15 674	17 391	16 410	19 578
Cyprus					
Bentonite	144 859	155 717	172 366	150 620	154 655
Czech Republic					
Bentonite	199 000	224 000	216 000	267 000	335 000
Denmark					
Bentonite	16 303	18 352	18 515	19 211	20 093
Georgia					
Bentonite	9 747	1 804	7 876	4 487	...
Germany					
Bentonite	478 796	404 549	352 374	363 998	384 709
Greece					
Bentonite	1 156 642	1 030 556	1 124 795	*1 100 000	*1 100 000
Hungary					
Bentonite	87 200	9 300	4 900	6 635	54 231
Italy					
Bentonite	474 475	437 659	445 573	469 654	599 735
Fuller's earth	250	300	...	...	...
Macedonia					
Bentonite	6 013	16 373	14 958	20 353	22 509
Poland	31 648	66 143	86 331	97 900	105 943
Romania					
Bentonite	17 637	18 161	18 190	21 165	14 713
Russia					
Bentonite	*500 000	*500 000	*500 000	456 000	*460 000
Slovakia					
Bentonite	98 000	98 000	97 000	136 000	149 000
Spain					
Bentonite	103 174	156 760	163 290	154 746	156 875
Attapulgite	18 975	20 796	20 565	20 933	24 284
Sepiolite	548 728	655 346	807 820	806 345	700 000
Turkey					
Bentonite	831 146	643 153	582 735	*400 000	*400 000
Sepiolite	*10 000	*10 000	*10 000	*10 000	*10 000
Ukraine					
Bentonite	*25 000	*25 000	*25 000	*25 000	*25 000
United Kingdom					
Fuller's earth (a)	33 900	27 540	6 200	—	—
Algeria					
Bentonite	28 064	32 200	29 029	27 110	32 600
Fuller's earth	2 573	2 284	831	—	—
Egypt					
Bentonite	...	…	6 320	*6 300	*6 300
Morocco					
Bentonite	71 544	40 000	64 000	21 100	137 100
Fuller's earth (f)	14 944	28 700	30 600	29 400	121 700
Mozambique					
Bentonite	684	578	547	692	*700
Senegal					
Attapulgite	176 857	*180 000	127 000	140 000	140 000
South Africa					
Bentonite	145 060	55 859	139 883	32 878	45 778
Attapulgite	14 585	20 419	34 340	49 225	65 402

Production of bentonite and fuller's earth

tonnes

Country	2003	2004	2005	2006	2007
Guatemala					
Bentonite	6 438	81 688	135 451	20 034	259 799
Mexico					
Bentonite	464 056	564 015	425 630	435 273	613 895
Fuller's earth	152 917	129 502	107 265	102 400	34 175
Nicaragua					
Bentonite	*6 300	*6 300	*6 300	*6 000	*6 000
USA					
Bentonite (c)	3 770 000	4 060 000	4 710 000	4 940 000	*5 070 000
Fuller's earth (c)	3 610 000	3 260 000	2 730 000	2 540 000	*2 670 000
Argentina					
Bentonite	146 845	163 028	247 101	256 165	250 260
Fuller's earth	*1 500	*1 500	*1 500	*1 500	*1 500
Brazil					
Bentonite	392 422	432 224	459 679	419 214	329 647
Chile					
Bentonite	748	101	—	—	533
Colombia					
Bentonite	*8 500	*8 500	*8 500	*8 500	*8 500
Peru					
Bentonite	15 290	10 510	14 663	14 590	21 451
Burma					
Bentonite (b)	856	*800	*800	*800	*800
China					
Bentonite	2 200 000	2 250 000	2 300 000	3 200 000	*3 200 000
India					
Bentonite (b)	*200 000	*410 000	*590 000	*610 000	*630 000
Fuller's earth (b)	*76 000	*144 000	*93 000	*50 000	*80 000
Indonesia					
Bentonite	*5 000	*5 000	*5 000	*5 000	*5 000
Iran					
Bentonite (d)	186 422	176 425	261 888	186 323	*180 000
Japan					
Bentonite	425 945	455 282	421 629	*425 000	*425 000
Fuller's earth	123 545	109 657	*110 000	*110 000	*110 000
Korea, Republic of					
Bentonite	40 095	99 173	85 177	61 137	56 429
Fuller's earth	32 685	26 487	84 632	46 314	65 136
Pakistan					
Bentonite (e)	9 432	6 316	15 671	20 088	33 177
Fuller's earth (e)	14 723	13 986	17 001	16 209	11 378
Philippines					
Bentonite	3 722	3 556	*2 000	1 000	1 148
Thailand					
Bentonite	1 100	1 350	32 500	1 200	650
Uzbekistan					
Bentonite	*15 000	*25 000	*35 000	*40 000	*40 000
Vietnam					
Bentonite	*20 000	*20 000	*20 000	*20 000	*20 000

Production of bentonite and fuller's earth

tonnes

Country	2003	2004	2005	2006	2007
Australia					
Bentonite (e)	144 755	264 038	227 433	*125 600	*107 200
Fuller's earth	11 187	10 142	9 784	*10 000	*10 000
New Zealand					
Bentonite	10 940	10 050	7 590	3 028	6 154
World Total Bentonite	12 700 000	13 300 000	14 400 000	14 800 000	15 700 000
World Total Fullers Earth (g)	4 800 000	4 600 000	4 200 000	3 900 000	4 000 000

Note(s):-
(1) Bentonites consist of montmorillonite (one of the smectite group of clay minerals) and occur in two main varieties, calcium bentonite, the most commonly occurring, and sodium bentonite, industrially the more important
(2) Calcium bentonite can be converted to sodium bentonite by a sodium-exchange process
(3) In some countries, such as the United Kingdom, calcium bentonite is known as fuller's earth, a term which is also used to refer attapulgite, a mineralogically distinct clay mineral but exhibiting similar properties
(4) In addition to the countries listed, Austria is believed to produce bentonite and France may produce fuller's earth

(a) Saleable production based on data from producing companies
(b) Years ended 31 March following that stated
(c) Sold or used by producers
(d) Years ended 20 March following that stated
(e) Years ended 30 June of that stated
(f) Smectite
(g) Including attapulgite and sepiolite

Production of beryl

tonnes

Country	2003	2004	2005	2006	2007
Madagascar (a)	*1	12	*1	*1	*1
Mozambique	78	45	146	16	*20
Uganda	...	207	19	—	—
Zambia	8	8	*10	*10	*10
USA	2 100	2 210	2 780	3 830	*2 500
Brazil	*4	*4	*4	*4	*4
China	*500	*500	*500	*500	*500

Note(s):-
(a) Includes ornamental and industrial products

Mine production of bismuth

tonnes (metal content)

Country	2003	2004	2005	2006	2007
Bulgaria	*40	*40	*40	*40	*40
Romania	*40	*40	*40	*40	*40
Russia	*50	*50	*50	*50	*50
Canada	166	223	170	222	*160
Mexico	1 064	1 014	970	1 186	1 170
Bolivia	72	62	44	155	147
Peru (b)	832	988	952	1 081	1 114
China (a)	1 036	1 857	1 886	1 900	1 900
Japan (b)	513	522	463	425	408
Kazakhstan	*150	*150	*140	*140	*140
Australia	*100	*100	*100	*100	*100
World Total	4 100	5 000	4 900	5 300	5 300

Note(s):-
(1) The figures in this table are in some instances derived from reported bismuth content of refined and impure metal plus recoverable in ores and concentrates exported
(2) Production for some countries may include bismuth produced from imported ores but it is thought that any resulting duplication is insignificant in the countries shown
(3) In addition to the countries listed, Brazil is believed to produce bismuth

(a) Exports of metal have always been higher than mine production in recent years
(b) Metal production

Production of borates

tonnes

Country	2003	2004	2005	2006	2007
Russia	*1 000 000	*500 000	*400 000	*400 000	*400 000
Turkey	1 324 000	1 727 000	2 087 000	2 373 345	*2 400 000
USA (a)	1 150 000	1 210 000	1 150 000	*1 150 000	*1 150 000
Argentina	512 167	821 031	632 792	533 535	669 578
Bolivia	109 545	68 031	63 499	50 727	79 531
Chile	400 603	594 191	460 683	459 645	527 929
Peru	11 072	9 729	8 290	*9 000	*9 000
China	*270 000	*275 000	*280 000	*290 000	*300 000
Iran (b)	2 126	2 142	1 660	1 974	*2 000
Kazakhstan	*30 000	*30 000	*30 000	*30 000	*30 000

Note(s):-
(a) Sold or used by producers
(b) Years ended 20 March following that stated

Production of bromine

kilograms

Country	2003	2004	2005	2006	2007
Germany	*500 000	—	—	—	—
Russia	*60 000	*60 000	*60 000	*60 000	*60 000
Spain	*100 000	*100 000	*100 000	*100 000	*100 000
Ukraine	1 324 000	1 878 000	3 138 000	*700 000	*1 800 000
United Kingdom	*25 000 000	—	—	—	—
USA (a)	216 000 000	222 000 000	226 000 000	243 000 000	*235 000 000
China	*42 000 000	*43 000 000	*43 000 000	*43 000 000	*43 000 000
India	1 560 000	1 730 000	2 420 000	2 130 000	*2 000 000
Israel	176 000 000	202 000 000	207 048 000	179 493 000	159 395 000
Japan	*20 000 000	*20 000 000	*20 000 000	*20 000 000	*20 000 000
Jordan	—	46 339	89 785	94 500	...
World Total	483 000 000	491 000 000	502 000 000	489 000 000	461 000 000

Note(s):-
(a) Elemental bromine sold as such or used in the preparation of bromine compounds by primary producers

Production of cadmium

tonnes

Country	2003	2004	2005	2006	2007
Bulgaria	307	356	319	320	318
France	*120	*120	*100	*90	*50
Germany	640	*640	*640	*640	*640
Italy	22	—	—	—	—
Macedonia	75	—	—	—	—
Netherlands	495	493	494	524	495
Norway	323	141	153	125	269
Poland	375	356	408	373	421
Russia	629	532	621	690	810
United Kingdom	22	—	—	—	—
Algeria	7 000	—	6	1 000	—
Canada (a)	1 759	1 880	1 727	2 090	1 388
Mexico	1 590	1 594	1 627	1 399	1 605
USA (a)	1 416	1 013	1 070	700	*700
Argentina	25	39	56	60	*60
Brazil	189	187	200	*200	*200
Peru	530	532	481	416	347
China	2 705	4 528	4 080	3 791	*3 800
India (b)	478	480	406	481	*584
Japan	2 509	2 233	2 297	2 286	1 939
Kazakhstan	930	2 358	1 624	*1 700	*1 700
Korea, Dem. P.R. of	*200	*200	*200	*200	*200
Korea, Republic of	2 175	2 362	2 582	3 320	2 846
Australia	673	469	429	425	*425
World Total	25 200	20 500	19 500	20 800	18 800

Note(s):-
(1) Data in this table excludes secondary metal unless otherwise stated

(a) Including cadmium sponge and/or secondary metal
(b) Years ended 31 March following that stated

Production of chromium ores and concentrates

tonnes

Country	2003	2004	2005	2006	2007
Albania	98 000	160 300	170 000	201 120	323 570
Finland	549 000	580 000	572 000	549 000	556 000
Russia	169 200	447 300	772 000	966 095	776 681
Turkey	229 294	506 421	858 729	1 059 901	1 678 932
Madagascar	45 040	77 386	93 384	116 290	122 260
South Africa	7 405 391	7 676 799	7 502 762	7 418 326	9 646 958
Sudan	37 000	26 000	21 654	24 200	37 656
Zimbabwe	572 558	668 391	614 720	700 001	663 593
Cuba	27 600	42 487	14 792	5 047	—
Brazil	376 862	593 476	616 534	562 739	627 772
Afghanistan	6 364	6 591	6 818	*6 800	*6 800
Burma (a)	*3 000	*3 000	*3 000	*3 000	*3 000
China	197 800	230 000	220 000	220 000	220 000
India (a)	2 904 809	3 621 394	3 714 284	4 095 513	4 821 207
Iran (b) (c)	150 316	134 872	224 911	244 603	185 760
Kazakhstan	2 927 900	3 287 100	3 581 242	3 366 078	3 687 200
Oman	13 800	28 700	34 000	67 000	337 970
Pakistan (d)	30 657	29 230	56 359	64 572	104 141
Philippines (b)	33 778	42 139	36 070	46 728	31 593
United Arab Emirates	—	7 089	—	—	19 000
Vietnam	91 000	82 000	5 700	3 400	2 800
Australia	67 271	110 273	90 260	107 103	99 147
World Total	15 900 000	18 400 000	19 200 000	19 800 000	24 000 000

Note(s):-
(1) In addition to the countries listed, Bulgaria is believed to produce chromite

(a) Years ended 31 March following that stated
(b) Including foundry sand and/or lumpy ore
(c) Years ended 20 March following that stated
(d) Years ended 30 June of that stated

COAL

Characteristics

Coal is a combustible sedimentary rock made of lithified plant remains. A coal seam is formed by the alteration of dead plant material that initially accumulates as peat on the land surface. As the peat becomes buried beneath younger sediments the temperature increases with increasing depth of burial. Peat is sequentially altered by the process of 'coalification', a process involving the loss of water and volatile components, through brown coals to black coals.

The physical and chemical properties of coal, that is coal quality, determine whether a coal can be used commercially. Calorific value, or the heat energy given off by the combustion of a unit quantity of fuel is one of the main quality criteria used by coal consumers. Coal quality is important as it affects the operation of plant, and thus the costs of generating power, through its impact on the costs of both maintenance and conformity with environmental legislation. Chlorine and sulphur are both detrimental in coal, causing pollution as well as corrosion in boilers.

Based on the physical properties of different bituminous coals, a fundamental distinction is made worldwide between steam coal (or thermal coal), used for burning in boilers, chiefly for electricity generation, and coking coal, which is used to make coke for the metallurgical industries. Coking coal produces coke with sufficient strength to support the loads imposed within a blast furnace. Steam coal tends to have calorific values at the lower end of the range.

Uses

Power generation is the primary use for coal. Roughly 40 per cent of electricity, worldwide, is generated from coal and this may be considerably higher in many individual countries. In the US, for example, a little over half of the electricity generated is through coal-fired power stations and in China, 70 per cent. Approximately 25 per cent of world primary energy consumption is from coal.

Almost two-thirds of world steel production is made from iron produced in blast furnaces which use coal, mainly in the form of coke. Coke is made from coking coals, which are characterised by their chemical and physical properties: they are low in sulphur and phosphorus, liquefy when heated in the absence of air and solidify into hard, porous lumps. The lumps of coke are produced by processing coal in a series of coke ovens with an oxygen-deficient atmosphere in order to concentrate the carbon. The coke has a high energy value and provides the permeability, heat and gases which are required to reduce and melt the iron ore, pellets and sinter consumed in iron-making. Another, less-used, method is pulverised coal injection, which can utilise a wide range of coals, including the less-expensive steam coal. About a third of world steel production is produced from scrap in electric arc furnaces, and it follows that much of the electricity for this process is produced from coal.

Liquid fuels derived from coal are sulphur-free and have low levels of nitrogen oxides and particulate matter. Coal may be converted into liquid fuel (and other products such as waxes, lubricants and chemicals) by two methods: direct liquefaction, where coal is dissolved in solvents at high temperature and pressure; and indirect liquefaction, which gasifies the coal to produce a 'syngas' which is then condensed over a catalyst (the Fischer-Tropsch process). The Fischer-Tropsch process produces a clean, high-quality product, whilst the liquid fuel produced through the direct process requires further refining. The South African company, Sasol, is the sole producer of liquid fuel and chemicals from coal on a commercial scale.

Coal is used as an energy source in cement production — a process that requires a large amount of energy. The coal consumed is half the mass of cement produced. Coal may also be gasified to produce a combination of hydrogen and carbon monoxide, which may be used for a range of purposes such as industrial heating, electricity generation and manufacture of chemicals. It is the source of numerous chemicals, as by-products, which are used in soap, pharmaceutical products, solvents, plastics, dyes and synthetic fibres. Coal is used in alumina refineries and in the production of activated carbon, carbon fibre and silicon metal.

World production in 2007

In 2007 world coal production was 6358 million tonnes. Annual production increased five to six per cent each year during the period 2003–06, with a slower rate of three per cent between 2006 and 2007. China was the largest producer with 2536 million tonnes, which is 40 per cent of world production. This represents a seven per cent increase on 2006 and a 46 per cent increase since 2003. In addition to being the largest producer China was a net importer of coal during the first half of 2007, although a net exporter, marginally, for the full year. The USA was the second largest producer with 1039 million tonnes and India, third, with production of 490 million tonnes.

Asia showed the largest growth in coal production. Although there was only a five per cent increase between 2006 and 2007, production in 2007 is 42 per cent higher than in 2003. Bangladesh and Malaysia, both small producers, show the fastest increases.

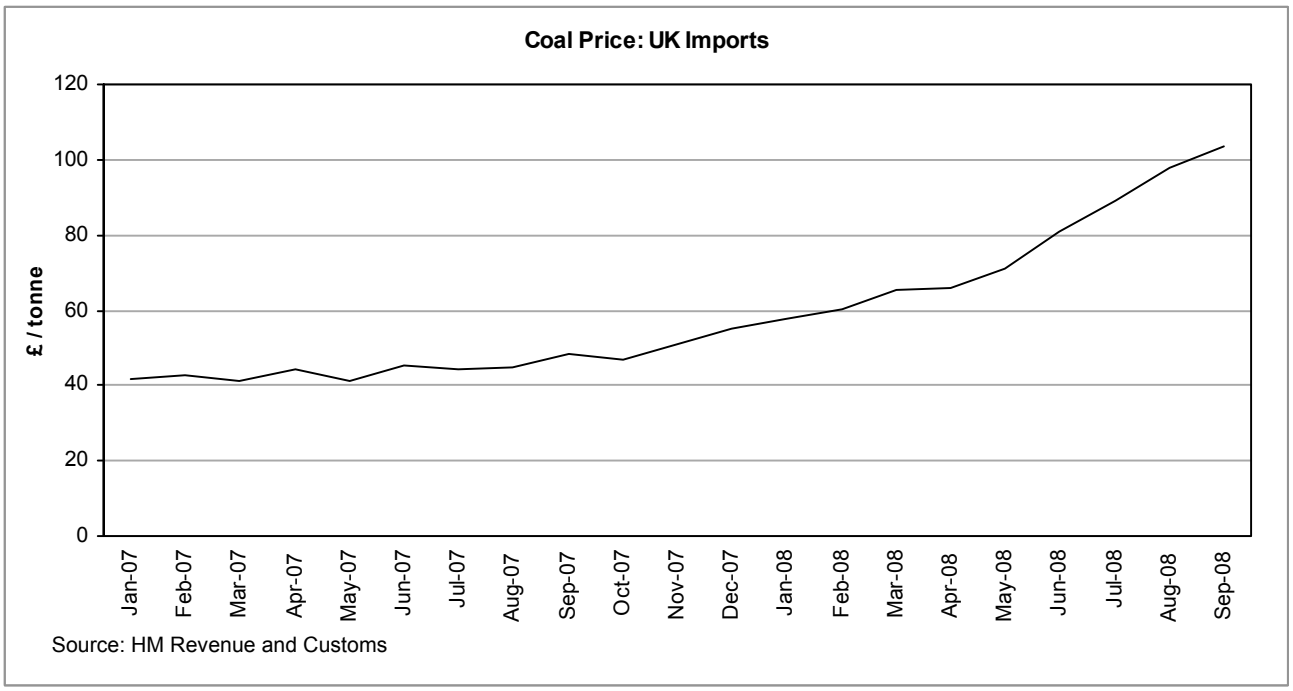
Coal production in Europe shows no net change in the period 2003 to 2007. Russia, the world's fifth largest producer, has increased production by 14 per cent while production fell in many other countries, including Poland, Slovakia, Spain, Ukraine and UK.

South Africa is the sixth largest coal-producing country in the world. Here, production of anthracite doubled during 2003–07 while bituminous coal production has been fairly level. Coal production in the Americas has increased by nine per cent over the same time span, with Peru, Argentina and Colombia showing the largest increases. Australian output (the fourth largest producer) increased by 14 per cent, mainly through increased production of bituminous coal.

Prices

The pricing of coal is complex, based on coal type, net calorific value and content of impurities such as sulphur. Additionally, the cost of transportation comprises a large proportion of the delivered price of coal. Coal is chiefly sold under long-term contracts that 'fix' the price of coal over the term of the contract, usually with an escalator based on inflation. Prices are normally quoted on a well-established world spot market.

Some organisations, such as the globalCOAL RB Index, base their price on a basket of different coal-type prices and incorporate an element of bid/offer data. The f.o.b. price of steam coal in international trade, in terms of globalCOAL's Richards Bay (RB) Monthly Index, increased throughout the first half of 2008, peaking at US$167.25 in July — 77 per cent



higher than in December 2007. This was due to supply constraints caused by severe weather and increasing demand in Asia. During the second half of the year the index fell to US$77.68**,** which is more representative of the normal situation.

Figure 1 shows the increase in average price, from £42 to £104, for UK imports of all types of hard coal during 2007 and nine months of 2008.

Industry events in 2008

In early 2008, the coal industry suffered from many of the same problems it encountered in 2007 — heavy rains and flooding in Australia, Indonesia and South Africa, coupled with capacity constraints at Newcastle port, Australia and Richards Bay Coal Terminal, South Africa. Coal shortages in South Africa led to power cuts which had consequent effects on industry, including mine output where the use of pumping and cooling equipment is essential. In addition to this, severe snow and ice storms early in the year caused problems with deliveries to power stations in southern China, resulting in power supply restrictions. Prices were high, encouraging expansion projects in many mines, but uncertainties in the credit markets caused problems, such as the liquids derived from coal project in West Virginia, USA, being abandoned (Synthetic Energy Systems, 2008). Freight costs were also high for much of the year.

The high price of coal and power shortages early in the year influenced metals operations in China. For example, despite aluminium prices rising to record levels, the Aluminium Corporation of China (Chalco) had to cease production due to electricity shortages (Mining Journal Online, 11 July 2008a). Production of nickel pig iron was affected as the government shut down furnaces to conserve energy, and costs increased due to the record prices for coking coal (Mining Journal Online, 11 July 2008b). In an attempt to conserve supplies of coal for power generation, Chinese coal-to-liquids projects were suspended, with the exception of the Shenua Group Corp. plants in Inner Mongolia and Ningxia. In September 2008, a 300-day trial operation was expected to commence at the plant in Inner Mongolia, which has a planned annual production of one million tonnes (Zhu, 2008).

Investment of A$5.4 billion in the Queensland rail network and ports is planned in order to facilitate coal exports (Mining Journal Online, 17 March 2008), while the number of ships queuing outside Newcastle port, Australia, seems to have eased somewhat compared to 2007.

In November, Mineweb reported that China's National Energy Administration is planning a legislative framework to create and manage a strategic coal reserve and the plan is undergoing public consultation (Kosich, 2008).

The Chinese government continues to close small coal mines, and this is having the desired effect of reducing fatalities. There are plans to continue to close thousands more coal mines, with a long-term goal of several large companies producing most of China's coal alongside approximately10 000 small mines (Alexander, 2008).

India's first coal-to-liquid project was approved in February. The Tata group partnered by Sasol of South Africa, the world's largest producer of oil from coal, will use the Fischer Tropsch technology (Airy, 2008). It is expected that this will encourage future coal-to-liquids projects.

BHP Billiton plans to develop high quality coking coal resources within the Maruwai Basin in Central Kalimantan, Indonesia — a location that is well placed to supply north Asian steel producers and the Chinese and Indian markets. The initial development involves a capital investment of approximately US$100 million and first production is expected in 2009 (BHP Billiton, 2008). PT Antam is reported to be considering buying coal mines, partly to meet the increasing energy needs for its nickel output and partly to diversify (Mining Journal Online, 19 September 2008). Heavy rains and flooding also affected deliveries from Indonesian mines in September.

Red Hill Energy announced in November that the Ulaan Ovoo Pre-Feasbility Study was in the third and final stage of completion. It is planned that this opencast operation in

northern Mongolia will produce six million tonnes of coal per year for approximately 20 years (Red Hill Energy Ltd, 2008). The first demonstration project for the capture of CO_2 commenced in April. The Otway Basin project, based in Victoria, Australia, aims to dispose of 100 000 tonnes of CO_2 in a depleted natural gas reservoir over two years. The project is managed by the CO_2 Co-operative Research Centre (CO2CRC) which is supported by the Australian government, and mining and oil companies. CO2CRC announced that it had stored 10 000 tonnes of CO_2 in early July 2008, and in October, 20 000 tonnes (CO2CRC, 2008) — equivalent to 20 per cent of the target. A new 30 MW clean coal pilot plant opened at Schwarze Pumpe in eastern Germany on 9 September 2008, and many other studies are taking place worldwide.

Hydrogen Energy, a Rio Tinto and BP joint venture, cancelled their plan to build a coal-fired power station with carbon capture and storage at Kwinana, Australia (Mining Journal Online, 16 May 2008), when they discovered that the rock formations may not provide reliable storage.

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Production of coal

tonnes

Country	2003	2004	2005	2006	2007
Albania					
Lignite	18 000	20 000	19 000	*20 000	*20 000
Austria					
Brown coal & lignite (i)	1 152 389	235 397	13 931	7 854	13 992
Bosnia & Herzegovina					
Brown coal & lignite	9 342 222	8 896 257	9 144 850	9 958 024	9 765 222
Bulgaria					
Anthracite & bituminous	53 000	170 000	—	—	—
Brown coal & lignite	27 641 000	26 455 000	24 615 300	25 306 400	28 158 500
Czech Republic					
Bituminous	13 382 000	14 648 000	12 778 000	13 017 000	12 462 000
Lignite	470 000	450 000	467 000	459 000	437 000
Brown coal	49 920 000	47 840 000	48 658 000	48 915 000	49 134 000
France					
Anthracite & bituminous	1 728 000	200 000	—	—	—
Lignite	9 000	—	—	—	—
Georgia	7 900	8 100	5 100	8 284	*8 000
Germany					
Anthracite & bituminous	25 873 043	25 871 882	24 909 867	20 882 119	21 531 956
Brown coal	179 086 776	181 926 060	177 907 945	176 324 117	180 411 991
Greece					
Lignite	71 000 000	71 600 000	70 600 000	64 800 000	62 500 000
Hungary					
Bituminous	667 126	280 000	—	885 849	838 672
Lignite	8 563 697	8 470 258	8 153 968	8 467 220	8 351 563
Brown coal	4 128 000	2 500 000	1 426 000	1 431 700	1 342 000
Macedonia					
Lignite	7 200 793	7 129 535	6 879 726	6 650 182	6 569 220
Montenegro					
Lignite	—	—	—	1 502 334	1 195 515
Norway					
Bituminous (d)	2 944 000	3 018 500	1 667 000	2 359 000	3 223 000
Poland					
Bituminous	103 016 400	100 087 100	97 903 730	95 222 512	88 313 369
Lignite	60 919 100	61 197 500	61 636 445	60 844 278	57 537 727
Romania					
Anthracite & bituminous	3 309 000	3 016 000	3 079 000	...	...
Lignite	30 871 000	29 726 895	28 491 480	32 753 526	*33 200 000
Brown coal	250 000	220 157	62 609	*58 000	...
Russia	277 000 000	280 000 000	299 000 000	310 000 000	315 000 000
Serbia					
Bituminous	—	—	—	65 000	66 000
Lignite	—	—	—	37 010 000	37 645 000
Brown coal	—	—	—	316 000	...
Serbia and Montenegro					
Bituminous	53 906	72 152	65 000	—	—
Lignite	34 542 677	35 267 074	35 853 000	—	—
Brown coal	377 187	352 474	363 000	—	—
Slovakia					
Brown coal	3 076 100	2 578 273	2 513 030	2 208 590	1 859 000
Slovenia					
Lignite	4 222 000	4 195 953	3 945 100	3 932 842	4 037 766
Brown coal	607 786	611 349	594 456	587 912	483 417
Spain					
Anthracite	3 857 364	3 692 220	3 888 838	3 775 504	3 484 305
Bituminous	5 547 150	5 220 407	4 664 589	4 572 350	4 384 603
Sub-bituminous	3 182 572	3 426 001	3 354 014	3 221 083	3 130 758
Lignite	7 977 546	8 146 908	7 587 113	6 859 641	6 179 954
Turkey					
Anthracite	3 090 458	2 842 952	2 785 505	3 070 793	2 702 331
Bituminous	336 714	738 915	737 701	*740 000	...
Lignite	43 749 420	43 754 159	60 867 574	61 010 000	58 421 000
Ukraine					
Bituminous	78 700 000	79 629 000	78 425 000	80 200 000	76 300 000
Lignite	640 000	523 000	313 000	231 000	182 000
United Kingdom					
Bituminous (g)	28 279 000	25 096 000	20 498 000	18 528 000	17 030 000

Production of coal

tonnes

Country	2003	2004	2005	2006	2007
Botswana	822 780	913 087	984 876	962 427	828 164
Congo, Democratic Republic					
Bituminous	*35 000	*33 000	*31 000	*29 000	*27 000
Egypt	139 000	138 800	75 000	*75 000	*75 000
Malawi	47 037	40 891	51 870	60 408	58 550
Mozambique					
Bituminous	36 742	16 525	3 417	40 957	*40 000
Niger	188 915	200 384	182 060	176 320	171 296
Nigeria					
Sub-bituminous	23 089	*10 000	*10 000	*10 000	*10 000
South Africa					
Anthracite	1 206 105	1 486 619	1 639 414	1 584 424	2 348 955
Bituminous	236 670 504	241 884 911	242 724 560	243 197 975	245 251 281
Swaziland					
Anthracite	*550 000	488 314	221 701	310 570	311 000
Tanzania					
Bituminous	54 610	65 041	30 795	17 940	27 198
Zambia					
Bituminous	718 000	*240 000	*240 000	*240 000	*240 000
Zimbabwe					
Bituminous	2 824 362	3 797 669	2 890 662	2 107 115	*2 107 000
Canada					
Bituminous	26 618 000	29 284 000	30 741 000	29 301 000	32 661 000
Sub-bituminous	24 880 000	25 147 000	25 742 000	26 153 000	26 011 000
Lignite	10 665 000	11 588 000	11 017 000	10 440 000	10 541 000
Mexico					
Bituminous	11 305 023	12 034 844	11 749 126	10 882 685	11 886 757
USA					
Anthracite (k)	1 169 000	1 542 000	1 542 000	1 395 000	*1 413 000
Bituminous (k)	491 240 000	509 384 000	518 193 000	509 512 000	*485 232 000
Sub-bituminous	401 520 000	422 204 000	430 648 000	467 510 000	*481 381 000
Lignite	78 380 000	75 750 000	76 113 000	76 430 000	*71 234 000
Argentina					
Bituminous	117 832	120 060	320 000	295 333	*300 000
Brazil					
Bituminous & lignite (e)	4 643 319	5 408 278	6 048 105	6 215 258	5 998 894
Chile					
Bituminous	136 495	140 186	138 056	98 673	184 122
Lignite	210 783	98 121	594 309	575 071	103 871
Colombia					
Bituminous	50 028 000	53 888 000	59 675 000	66 192 000	69 902 000
Peru					
Anthracite & bituminous	17 104	57 759	29 535	107 091	279 140
Venezuela					
Bituminous	7 033 729	8 107 304	7 194 882	7 458 873	8 038 000
Afghanistan					
Bituminous	*2 000	*2 000	*2 000	*2 000	*2 000
Bangladesh (j)	22 322	64 605	87 143	303 016	*1 000 000
Bhutan	66 324	29 631	85 279	97 965	105 261
Burma (h)	109 214	237 949	229 647	*230 000	*230 000
China					
Anthracite	218 000 000	220 000 000	*247 000 000	*266 000 000	*284 000 000
Bituminous	1 470 000 000	1 690 000 000	*1 901 000 000	*2 046 000 000	*2 186 000 000
Lignite	52 000 000	50 000 000	*57 000 000	*61 000 000	*66 000 000
India					
Bituminous (h)	361 156 000	382 615 000	407 039 000	430 850 000	456 428 000
Lignite (h)	27 958 000	30 337 000	30 066 000	31 130 000	33 760 000
Indonesia					
Anthracite & bituminous	114 278 000	132 352 000	152 722 000	193 761 000	174 794 000
Iran					
Bituminous (c)	2 170 079	2 079 604	1 898 417	*2 000 000	*2 000 000
Japan					
Bituminous	1 353 379	1 339 447	1 146 491	1 341 000	*1 300 000

Production of coal

tonnes

Country	2003	2004	2005	2006	2007
Kazakhstan					
Bituminous	80 497 400	82 929 900	81 869 200	*91 500 000	*90 000 000
Lignite	4 219 500	3 945 200	4 498 500	4 655 100	4 370 100
Korea, Dem. P.R. of					
Anthracite	16 000 000	16 300 000	16 500 000	17 200 000	17 100 000
Lignite	6 300 000	6 500 000	7 000 000	7 500 000	7 000 000
Korea, Republic of					
Anthracite	3 298 000	3 191 212	2 831 658	2 823 990	2 886 000
Kyrgyzstan	415 300	456 300	300 000	300 000	400 000
Laos	212 819	332 907	232 934	233 000	*580 000
Malaysia	174 800	389 176	789 356	901 801	1 063 078
Mongolia					
Brown coal & lignite	5 666 100	6 865 000	7 517 100	8 074 100	9 237 600
Nepal					
Sub-bituminous (b)	11 848	10 459	9 259	11 963	16 274
Pakistan (a) (j)	3 609 338	3 325 408	3 367 021	3 880 604	3 702 162
Philippines					
Bituminous	2 029 303	2 726 500	3 164 432	2 529 309	3 721 537
Tajikistan	46 500	88 300	94 900	218 000	268 000
Thailand					
Lignite	18 843 395	20 059 845	20 878 176	19 070 608	18 239 176
Uzbekistan					
Bituminous	61 600	*81 000	95 040	99 200	*99 000
Lignite	1 850 000	*2 700 000	3 072 960	2 720 000	*2 700 000
Vietnam					
Anthracite	19 314 000	27 349 000	34 396 000	38 778 000	43 190 000
Australia					
Bituminous (f)	280 700 000	294 810 000	308 000 000	315 000 000	324 000 000
Brown coal (j)	66 809 000	66 343 000	67 152 000	67 737 000	65 613 000
New Zealand					
Bituminous	2 351 021	2 526 613	2 543 404	2 863 029	2 019 430
Sub-bituminous	2 576 555	2 389 352	2 477 312	2 653 516	2 555 830
Lignite	252 336	239 429	246 445	251 366	260 148
World Total	5 210 000 000	5 547 000 000	5 898 000 000	6 189 000 000	6 357 000 000

Note(s):-
(1) There is no international agreement as to the separate definition of lignite and brown coal. In some cases they are distinguished. Elsewhere both may be aggregated under one or other term

(a) Including lignite
(b) Years ended 15 July of that shown
(c) Years ended 20 March following that stated
(d) Spitzbergen: not including production from mines controlled by the former Soviet Union
(e) Including beneficiated and directly shipped material
(f) Including sub-bituminous
(g) Including anthracite
(h) Years ended 31 March following that stated
(i) Coal; all forms
(j) Years ended 30 June of that stated
(k) Includes a small amount of refuse recovery

Mine production of cobalt

tonnes (metal content)

Country	2003	2004	2005	2006	2007
Russia (a)	4 654	4 527	4 748	4 759	3 587
Botswana	294	223	326	303	242
Congo, Democratic Republic	*14 500	*20 200	*24 500	*27 100	*25 300
Morocco	1 391	1 600	1 600	300	200
South Africa	271	309	268	267	307
Zambia	6 620	5 791	5 472	4 648	4 229
Zimbabwe	44	59	275	290	*300
Canada	4 327	5 060	5 767	7 115	8 261
Cuba	3 643	3 979	*3 768	*4 000	*4 000
Brazil	4 200	4 300	*4 300	*4 300	*4 300
China	707	1 253	2 104	1 840	*2 000
Indonesia	*650	*650	*650	*650	*650
Australia (b)	2 562	2 004	5 198	*5 700	*5 600
New Caledonia	2 602	2 726	1 769	1 629	1 620
World Total	46 000	53 000	61 000	63 000	61 000

Note(s):-
(1) There is frequently a considerable disparity between the cobalt content of ore raised and cobalt actually recovered
(2) Figures in this table relate where possible to cobalt recovered. The principal exceptions to this are Brazil and New Caledonia, the figures for which relate to cobalt in ore raised

(a) Metal
(b) Years ended 30 June of that stated

Production of cobalt metal

tonnes

Country	2003	2004	2005	2006	2007
Belgium	1 704	(d) 2 947	(d) 3 298	(d) 2 840	(d) 2 825
Finland	7 989	7 893	8 171	8 582	9 173
Norway	4 556	4 670	5 021	4 927	3 939
Russia	4 654	4 524	4 748	4 759	3 587
Congo, Democratic Republic (c)	1 200	735	600	550	608
Morocco	1 341	1 593	1 613	1 405	1 591
South Africa (b)	271	329	268	267	307
Uganda	—	459	638	689	698
Zambia	6 620	5 791	5 422	4 556	4 425
Canada (a)	4 233	5 144	5 090	5 180	5 620
Brazil	1 097	1 155	1 136	902	1 148
China	4 576	(d) *8 000	(d) *12 700	(d) *12 700	(d) 13 245
India	255	545	1 220	1 184	980
Japan	379	421	471	920	1 085
Australia	3 839	3 879	3 150	3 996	3 684
World Total	42 700	48 100	53 500	53 500	52 900

Note(s):-
(1) In addition to the production listed above, several countries, including the United Kingdom, Finland and France, are known to produce substantial amounts of cobalt compounds

(a) Including oxides
(b) Includes metal and metal contained in sulphate
(c) Excludes white alloy and matte which are believed to be further processed in Belgium and elsewhere
(d) Some metal production in China is recorded in Belgium

COPPER

Characteristics

Copper is a reddish, malleable and ductile metal valued for its excellent thermal and electrical conductive properties and its resistance to corrosion. Copper combines with a number of elements to form a wide variety of copper minerals and ores. More than 150 copper-bearing minerals have been identified although only a small number of these, chief of which is chalcopyrite ($CuFeS_2$), are of economic importance. The upper parts of orebodies often also contain 'oxide' ore minerals such as malachite and chrysocolla. These are underlain by a layer of 'sulphide enrichment' characterised by the sulphide mineral, chalcocite. Types of copper orebody include: 'porphyries', typical of North and South America, where disseminated copper minerals are associated with igneous intrusions; stratabound orebodies where the copper occurs in sedimentary rocks; and volcanic-hosted massive sulphide (VMS) deposits, in which copper is associated with other base metal sulphides such as lead and zinc. The largest reserves are in Chile (150 million tonnes), Indonesia and USA (35 million tonnes each), Mexico, Peru and Poland (30 million tonnes each) (Edelstein 2008).

Uses

The ability to conduct electricity and heat are two of the most important properties of copper, since about 40 per cent (in Europe) of all copper produced is used in electrical and electronic applications (International Copper Study Group, 2007). When alloyed with other metals it acquires additional properties including: increased hardness, tensile strength, and improved corrosion resistance. Brass and bronze are two of the most important alloys of copper. Copper's malleability and ease of use in machines during the fabrication process allows for a high production rate of accurate copper shapes for a relatively lower cost than that of its substitutes. Copper is a major industrial metal, due to its beneficial properties discussed here, ranking third after iron and aluminium in terms of quantity consumed.

Statistics for the final applications of copper products vary widely: in the USA the dominant sector is 'construction' (50 per cent), in Europe it is 'transport' (41 per cent) and in Asia 'electrical' (33 per cent) (International Copper Study Group, 2007). These differences are at least partly caused by differing statistical methodologies. The chief immediate use of copper is in electrical circuits, wiring and cables, regardless of the final application. Copper is used in many forms in buildings including wire, plumbing pipes and fittings, electrical outlets, switches, and locks. Construction of an average modern house requires at least 200 kg of copper metal. Copper roofing is highly rated for its corrosion resistance and architectural characteristics. Copper is the best electrical conductor after silver and is widely used in the production of energy-efficient power circuits. Copper wire is extensively used in telecommunications and is essential for computer networks.

World production in 2007

Copper is produced in about fifty countries. Nine countries account for about 80 per cent of world mine production. Each of these nine countries produce over 500 000 tonnes of copper per year.

In the last 20 years, copper production has almost doubled from 8.8 million tonnes in 1988 to more than 15 million tonnes in 2007. This sustained rise can be attributed to the steady increase in copper demand from growing economies around the world. The proportion of copper mined in South America has increased from about one-quarter to nearly one-half of total world production. This is largely due to an increase in production from Chile, from 17 per cent of world production in 1988 to 36 per cent in 2007. Total production from North and Central America has not increased significantly, despite a 26 per cent rise in Mexican output. The contribution from Asia has been increasing and Africa's copper production has also risen in recent years driven by Zambia and the Democratic Republic of Congo (DRC). Zambia's mine production has increased by 70 per cent from 307 834 tonnes in 2002 to 523 435 tonnes in 2007. The DRC copper production has risen rapidly during the last five years as stability returns to the country, following five years of war. DRC, which has the potential to become an extremely significant copper producer, increased copper production from 28 000 tonnes in 2002 to 143 000 tonnes in 2007.

Rising demand for copper has meant that many mines are now operating at almost full capacity. Smelter and refinery capacities are becoming a bottleneck to production. This coupled with limited expansion potential and diminishing ore reserves of existing mines, means that production is likely to level off unless the record high copper prices of recent years are reinvested into exploration and future production infrastructure. Copper mine production depends on a relatively small number of large production units. It is therefore vulnerable to disruptions caused by strikes, natural disasters and concerns over supplies of energy and water. Improved mining and extraction techniques now allow copper from low grade ores, that were previously considered as waste, to be extracted using chemical and bio-leaching techniques. However, in many cases the leach cycle may be measured in years, resulting in a considerable lag time in copper metal production by these methods.

Total world copper mine production in 2007 was 15.5 million tonnes. Chile is the largest copper-producing country, with an output of 5.6 million tonnes in 2007. Total world production of smelter copper was 12.2 million tonnes in 2007, with Asia contributing 48 per cent of the world total. During the last 10–15 years mine production statistics have become decoupled from total smelter production, whereas prior to 1990 the two correlated very well. This statistical divergence is explained by the increasing use of chemical extraction techniques which compete with conventional smelter production. Total world refined copper production was 20.9 million tonnes in 2007, from over 45 countries. The difference between mine and refinery production is attributed to the contribution of secondary refined (scrap) copper to the total. Recycling of old scrap provides about 20 per cent of annual copper consumption.

Prices

The price paid for copper on the metal exchanges primarily reflects global balances of copper supply and demand, but may be significantly affected by speculative activity, currency exchange rates and market news. Copper demand and price typically reflect global economic cycles, and as a result the copper price has historically experienced major fluctuations. All copper prices quoted are based on the London Metal Exchange (LME) cash daily official price, in US dollars per tonne, as quoted by Metal Bulletin (2009).
Copper prices increased rapidly in early 2008 exceeding US$7300 per tonne in January. Prices accelerated upwards during February driven by supply concerns, falling LME inventories and increasing demand from emerging economies

Copper cash LME daily offical price. Source: Metal Bulletin 2009 (w w w .metalbulletin.com)

reaching a new record high of US$8881 per tonne in early March, a 33 per cent increase since the start of 2008. Prices during the later part of March fell over concerns of declining demand from the deteriorating US economy. Prices recovered during late March as LME inventories declined reaching another record high in early April. Prices for the remainder of April remained high, fluctuating in response to the weakening US dollar, supply concerns due to labour disputes at Chilean mines and low LME stockpiles.

During May and into June prices were generally on a downwards trend varying with the strength of the US dollar, concern over strike action in South America and fears of future reducing copper demand from China. From mid June onwards copper prices began to rise in response to the weakening US dollar, record oil prices and a strike at Peru's largest mine. Prices continued to rise reaching an all-time record high of US$8985 in July largely supported by supply concerns due to strikes at Peruvian mines in conjunction with the continued weakness of the US dollar and a strong oil price (Metal Markets, 2008a).

Following the record high in July the copper price declined sharply over the remainder of the year, in response to the deteriorating global economic climate. Copper prices decreased during July over concerns that slowing economic growth could reduce consumption of metals. Copper prices fell further during August on news that Japan may be entering a recession, weakening Chinese demand and as the global economic outlook worsened and stockpiles expanded (Metal Markets, 2008b,c). By the end of August copper prices were 16 per cent lower than the July record. Prices fluctuated during September as a result of further demand concerns, the US government takeover of mortgage lenders, an earthquake in Chile and news of a decline in US house building (Metal Markets, 2008d).

Demand concerns continued to push the copper price lower during October with the price falling more than US$400 on a single day to US$5000 per tonne as a result of a global plummet in equity markets (Metal Markets, 2008e). Prices continued to slide during the remainder of October in response to declining US manufacturing output, strengthening of the US dollar and rising warehouse inventories (Metal Markets, 2008f). During November and December the worsening global economy and poor metal demand outlook caused prices to continue their sharp downwards trend. By mid December copper prices had fallen below US$3000 per tonne reaching a low of US$2770, its lowest prices since September 2004 and a fall of around 69 per cent since the July 2008 peak. The average copper price for 2008 was approximately US$6900 per tonne, around 3 per cent lower than in 2007.

Industry events in 2008

Supply disruptions were a notable feature of the copper market in 2008, largely resulting from strike action at mines in Latin America, equipment failures and lower ore grades (Lampard, 2008). The strike at Grupo Mexico's Cananea copper mine in Mexico continued into its second year. In May restrictions on electricity consumption by mining operations in the Democratic Republic of Congo's (DRC) major copper-producing Katanga province affected production (Mineweb, 2008a). Also during May a three-week-long strike by subcontractors at Codelco operations in Chile affected production (Mineweb, 2008b). In June Zambian copper mines were affected by power shortages resulting from problems with energy supplies from the DRC (Mineweb, 2008c). During June and July strikes in Peru, the world's second largest copper producer affected a number of mines across the country. In October a five-week strike impacted on the processing operations at the Kidd Creek mine in Canada (Mineweb, 2008d). Chilean production in 2008 was affected by lower ore grades at some operations including Escondida, owned by BHP Billiton and at Codelco Norte where plans to exploit high-grade ore were delayed. Escondida, the world's largest copper mine also suffered problems with a grinding

mill, reducing its 2008 production by up to 10 per cent (Jordon, 2008a).

A number of new projects and mine expansions were planned or commissioned during 2008. In Chile work on expansion of the Collahuasi mine continued during 2008 and further plans have been approved to improve the production process (Business News Americas, 2008). Codelco's commissioned its new Gaby mine in Chile which reached full output in November 2008. Codelco has already approved an expansion plan which will raise the mine output to 170 000 tonnes per year (Jordan 2008b). Zambia's Lumwana copper mine started production at the end of 2008 and is projected to produce 172 000 tonnes of copper annually (Mineweb 2008e). Konkola Copper Mines has open its new Nchanga smelter on the Zambian Copperbelt which will produce 250 000 tonnes of copper annually (Konkola Copper Mines, 2008). During 2008, Gold Fields commissioned its new Cerro Corona gold-copper mine in Peru and the first concentrate shipment is planned for 2009 (Your Mining News, 2008; Gold Fields, 2008). During 2008 a period of trial production commenced at China's largest copper mine the Yulong project in Tibet (Mineweb, 2008f).

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Mine production of copper

tonnes (metal content)

Country	2003	2004	2005	2006	2007
Albania	—	642	1 696	400	1 300
Armenia	18 068	17 700	16 400	17 800	17 400
Bulgaria	91 600	79 600	82 700	99 000	99 000
Cyprus	2 500	—	—	900	2 900
Finland	14 900	15 500	15 000	13 000	13 600
Georgia	14 700	*12 000	*6 000	14 600	11 000
Macedonia	618	—	4 799	7 054	7 029
Poland	503 544	530 768	511 799	497 200	451 900
Portugal	77 581	95 700	89 541	78 576	90 182
Romania	23 389	20 380	16 286	12 535	2 213
Russia	650 000	630 000	640 000	675 000	690 000
Serbia	—	—	—	11 100	16 500
Serbia and Montenegro	15 500	13 800	11 600	—	—
Spain	635	1 308	7 358	8 700	6 281
Sweden	83 143	82 415	87 068	86 746	62 905
Turkey	43 245	38 876	30 067	*30 000	*80 000
Botswana	24 289	21 195	26 704	24 255	19 996
Congo, Democratic Republic	56 900	69 600	98 000	131 400	143 000
Mauritania	...	...	...	5 031	28 755
Morocco	4 818	2 900	3 200	4 600	5 600
Namibia	16 175	11 174	10 157	6 262	5 500
South Africa	89 338	85 710	85 000	89 700	97 000
Tanzania	3 715	4 240	3 661	3 285	3 276
Zambia	346 900	410 300	465 002	515 618	523 435
Zimbabwe	1 374	2 383	2 570	2 581	3 000
Canada	557 082	562 795	595 383	603 295	589 115
Mexico	355 653	405 539	429 042	334 129	337 527
USA	1 116 000	1 160 000	1 140 000	*1 220 000	1 188 000
Argentina	199 020	177 143	187 317	180 144	180 200
Brazil	26 275	103 153	133 325	147 836	205 728
Chile	4 904 200	5 412 500	5 320 500	5 360 800	5 557 000
Colombia	1 500	1 600	1 800	600	840
Peru	842 578	1 035 574	1 009 898	1 048 472	1 190 281
Burma	27 900	31 800	34 500	19 500	15 100
China	614 400	754 200	776 000	889 000	946 400
India (a)	29 529	30 072	28 602	34 120	*37 000
Indonesia	1 005 837	840 318	1 063 849	817 796	796 899
Iran	146 100	153 000	149 900	216 200	249 100
Japan	1 000	1 000	*1 000	*300	—
Kazakhstan	484 500	461 800	401 700	446 300	406 500
Korea, Dem. P.R. of	*12 000	*12 000	*12 000	*12 000	*12 000
Laos	—	1 700	30 480	60 803	62 541
Mongolia	130 300	129 990	126 560	129 675	130 200
Oman	—	—	—	—	9 100
Pakistan	5 400	14 700	17 700	18 700	18 800
Philippines	20 414	15 984	16 320	17 161	22 862
Saudi Arabia	800	652	668	730	700
Uzbekistan	*80 000	83 000	103 500	103 500	103 500
Vietnam	1 200	2 000	3 100	11 400	12 500
Australia	830 000	854 000	935 000	878 000	871 000
Papua New Guinea	202 300	173 370	192 978	194 355	169 184
World Total	13 700 000	14 600 000	14 900 000	15 100 000	15 500 000

Note(s):-
(a) Years ended 31 March following that stated

Smelter production of copper

tonnes

Country	2003	2004	2005	2006	2007
Armenia	6 259	9 470	9 881	8 791	*7 000
Bulgaria	199 300	215 800	225 000	217 000	217 600
Finland	160 596	151 647	157 933	164 306	118 911
Germany	288 800	278 600	257 200	273 800	275 300
Norway	35 851	35 643	38 681	39 700	34 200
Poland	559 960	547 228	555 681	555 907	518 303
Romania	4 473	61	—	—	—
Russia	662 000	661 900	695 500	635 000	650 000
Serbia	—	—	—	40 000	30 200
Serbia and Montenegro	15 100	13 900	30 000	—	—
Spain	290 282	224 249	284 215	263 662	256 300
Sweden	175 475	174 459	168 763	129 951	148 835
Turkey	18 400	34 700	27 700	26 300	17 900
Botswana	27 400	21 200	28 100	29 700	13 400
Congo, Democratic Republic (a)	8 000	20 000	10 000	10 000	1 800
Namibia	26 306	24 704	21 699	21 918	20 600
South Africa	112 000	89 300	105 500	98 900	111 900
Zambia (a)	245 000	280 100	244 800	289 700	224 000
Canada	430 116	446 209	441 325	484 675	470 713
Mexico	260 754	298 702	340 462	298 526	294 746
USA	538 700	542 100	523 000	501 000	620 600
Brazil	173 378	208 020	199 043	219 684	218 000
Chile	1 542 400	1 517 600	1 558 100	1 565 400	1 514 300
Peru	314 228	320 135	321 968	322 188	236 809
China	1 379 200	1 502 900	1 751 500	1 917 500	2 048 800
India	386 200	399 600	482 300	609 600	699 900
Indonesia	247 400	211 600	275 000	201 200	270 000
Iran (b)	145 670	152 463	*200 000	*210 000	*210 000
Japan	1 278 380	1 220 448	1 266 432	1 361 771	1 383 372
Kazakhstan	431 930	444 537	404 817	424 784	392 834
Korea, Dem. P.R. of	*10 000	*10 000	*10 000	*10 000	*10 000
Korea, Republic of	410 000	392 500	436 600	449 200	475 000
Oman	17 000	17 100	24 500	20 700	13 900
Pakistan	4 900	13 000	18 600	23 600	18 200
Philippines	227 900	217 300	201 300	239 600	219 900
Thailand	—	17 700	28 600	1 000	5 600
Uzbekistan	77 000	103 400	115 000	93 000	90 200
Vietnam	—	—	—	4 800	11 000
Australia	435 000	443 000	410 000	377 000	399 000
World Total	11 100 000	11 300 000	11 900 000	12 100 000	12 200 000

Note(s):-
(1) This table shows primary metal in the form of blister and anode produced from concentrates, and may include copper produced from scrap but this is excluded when it can be separately identified

(a) Including leach cathodes
(b) Years ended 20 March following that stated

Production of refined copper

tonnes

Country	2003	2004	2005	2006	2007
Austria	65 100	74 200	72 300	72 600	81 400
Belgium	423 000	383 000	382 900	378 600	394 000
Bulgaria	45 900	55 300	60 100	65 500	70 000
Cyprus	2 552	1 344	—	880	3 012
Finland	135 713	132 384	132 126	137 961	109 870
Germany	597 531	652 600	638 800	662 338	665 517
Italy	26 700	33 600	32 200	36 400	28 600
Norway	35 852	35 643	38 681	39 700	34 200
Poland	529 616	550 066	560 256	556 625	532 975
Romania	16 739	24 526	20 739	21 583	18 589
Russia	842 000	919 000	934 900	943 200	934 000
Serbia	—	—	—	41 400	31 600
Serbia and Montenegro	14 029	11 998	31 300	—	—
Spain	293 495	228 466	313 105	299 146	308 100
Sweden	214 181	235 620	223 482	229 241	213 894
Turkey	36 900	63 800	94 900	105 800	99 600
Ukraine	16 800	5 500	13 600	17 300	19 500
Congo, Democratic Republic	20 000	20 000	20 000	24 200	32 800
Egypt	14 119	14 119	18 469	*18 000	*18 000
South Africa	93 300	87 300	98 600	100 300	110 700
Zambia	360 100	409 500	445 600	497 200	523 400
Zimbabwe	5 000	5 800	6 000	6 700	6 000
Canada	454 866	526 955	515 223	500 463	453 453
Mexico	295 800	333 700	377 500	303 626	3 329 746
USA	1 306 300	1 310 800	1 255 800	1 249 800	1 408 475
Argentina	*16 000	*16 000	*16 000	*16 000	*16 000
Brazil	173 378	208 020	199 043	219 684	218 000
Chile	2 901 900	2 836 700	2 824 000	2 811 300	2 936 500
Peru	517 046	505 306	510 392	507 710	413 907
Burma	27 900	31 800	34 500	19 500	15 100
China	1 836 300	2 198 700	2 606 800	3 002 100	3 544 800
India (b)	395 967	413 354	529 248	512 363	*511 000
Indonesia	223 300	210 500	262 900	217 600	265 900
Iran (a)	168 613	182 814	*180 000	*201 000	*204 000
Japan	1 430 365	1 380 144	1 395 284	1 532 055	1 576 818
Kazakhstan	432 401	445 792	418 865	429 729	408 026
Korea, Dem. P.R. of	*15 000	*15 000	*15 000	*15 000	*15 000
Korea, Republic of	509 970	495 952	526 563	561 500	566 400
Laos	—	—	30 480	60 803	62 541
Mongolia	1 341	2 376	2 475	2 618	3 007
Oman	17 040	...	24 500	20 700	13 900
Philippines	171 200	174 600	172 000	181 000	160 200
Thailand	—	20 000	26 100	27 050	12 714
Uzbekistan	77 000	103 800	115 000	92 800	89 600
Vietnam	—	—	—	4 800	11 000
Australia	484 000	498 000	469 000	429 000	442 000
World Total	15 200 000	15 900 000	16 600 000	17 200 000	20 900 000

Note(s):-
(1) Figures relate to both primary and secondary refined copper, whether electrolytic or fire refined. Metal recovered from secondary materials by remelting alone is excluded
(2) In addition to the countries listed, Albania and Colombia produce refined copper

(a) Years ended 20 March following that stated
(b) Years ended 31 March following that stated

Production of diamond

carats

Country	2003	2004	2005	2006	2007
Russia	33 020 000	38 865 770	38 000 990	38 360 810	38 291 200
Angola	*6 300 000	6 146 361	7 079 121	9 175 061	9 701 709
Botswana	30 412 155	31 125 000	31 889 771	34 293 401	33 639 000
Cameroon (b)	5 500	12 000	*12 000	*12 000	*12 000
Central African Republic	331 543	354 703	382 756	419 528	467 711
Congo, Democratic Republic	29 000 000	30 040 479	33 054 998	28 990 241	28 452 496
Ghana	904 089	905 344	1 065 923	959 405	839 235
Guinea	666 000	739 784	548 522	473 862	1 018 723
Ivory Coast	230 000	*300 000	*300 000	*300 000	*300 000
Lesotho	1 899	26 607	52 036	231 325	454 014
Liberia	60 000	11 000	11 000	11 000	21 700
Namibia	1 454 756	2 003 868	1 902 484	2 356 285	2 266 100
Sierra Leone	506 819	693 104	668 807	582 324	603 698
South Africa	12 673 379	14 294 662	15 775 720	15 152 801	15 247 122
Tanzania	236 382	303 920	219 640	272 204	282 786
Togo	87 200	123 106	11 773	25 368	13 452
Zimbabwe	—	44 454	243 928	1 046 025	695 016
Canada	10 755 654	12 618 080	12 314 000	13 233 813	17 007 850
Brazil	*400 000	*300 000	207 836	181 350	182 031
Guyana	412 538	454 940	356 948	340 544	268 945
Venezuela	38 489	40 036	55 154	27 598	14 502
China	1 190 000	*1 060 000	*1 060 000	*1 065 000	*1 000 000
India (a)	71 259	78 315	44 170	2 179	587
Indonesia	*30 000	*30 000	21 606	46 856	22 980
Australia	31 013 000	20 620 000	30 678 000	29 308 000	19 231 000
World Total	159 800 000	161 200 000	176 000 000	176 900 000	170 000 000

Note(s):-
(1) This table does not show production of synthetic diamond
(2) So far as possible the amounts shown include estimates for illegal production

(a) Years ended 31 March following that stated
(b) Including artisanal production

Production of diatomite

tonnes

Country	2003	2004	2005	2006	2007
Commonwealth of Independent States (f)	*80 000	*80 000	*80 000	*80 000	*80 000
Czech Republic	4 800	3 800	4 100	4 827	3 600
Denmark					
Moler (d)	221 000	188 000	209 000	196 000	201 000
France	*80 000	*75 000	*75 000	*75 000	*75 000
Hungary	1 770	1 640	2 190	495	1 424
Iceland	27 693	20 625	—	—	—
Poland	700	800	500	600	—
Romania	33 296	20 626	1 402	1 719	15
Spain (b)	57 934	33 799	44 335	52 123	45 000
Algeria	2 335	2 665	1 814	1 800	1 902
Ethiopia	...	2 000	420	—	*—
Kenya (g)	353	330	243	185	201
Costa Rica	1 422	196	255	255	*255
Mexico	53 395	59 818	62 132	62 948	82 519
USA (c)	599 000	620 000	653 000	799 000	*830 000
Argentina	35 518	8 180	34 045	38 543	39 000
Brazil	6 920	7 200	7 670	8 968	5 555
Chile	25 594	30 015	27 091	19 104	25 405
Colombia	*4 000	*4 000	*4 000	*4 000	*4 000
Peru	*35 000	*35 000	*35 000	*35 000	21 603
China	*380 000	370 000	400 000	*420 000	*420 000
Iran (a)	1 000	1 000	1 450	13 400	...
Japan	111 690	126 255	130 005	*130 000	*120 000
Korea, Republic of	15 636	2 441	2 193	3 460	2 360
Saudi Arabia	1 000	*1 000	*1 000	*1 000	*1 000
Thailand	1 288	1 372	990	1 344	1 260
Vietnam	*10 000	*10 000	*10 000	*10 000	*10 000
Australia (e)	31 758	34 571	33 827	*34 000	*34 000
World Total	1 825 000	1 740 000	1 822 000	1 994 000	2 018 000

Note(s):-
(1) In addition to the countries listed, Egypt and Turkey are believed to produce diatomite

(a) Years ended 20 March following that stated
(b) Including tripoli
(c) Sold or used by producers
(d) Moler is an impure diatomite containing a large proportion of clay
(e) Years ended 30 June of that stated
(f) Diatomite is produced in Armenia, Georgia and Russia but information is not available to provide estimates for individual countries
(g) Exports

Production of feldspar

tonnes

Country	2003	2004	2005	2006	2007
Bulgaria	*35 000	86 608	72 867	93 091	*90 000
Czech Republic	421 000	488 000	472 000	487 000	514 000
Finland	59 362	44 495	42 783	43 187	48 980
France	654 000	628 000	651 000	*650 000	*650 000
Germany	233 028	182 842	168 640	167 332	171 303
Greece	102 800	88 274	100 586	*100 000	*100 000
Italy	2 343 722	3 251 264	3 334 848	4 019 495	4 726 908
Macedonia	25 640	22 921	27 076	38 124	32 814
Norway	70 000	67 000	*67 000	65 000	65 000
Poland	276 264	373 459	426 914	457 600	*388 500
Portugal	197 866	221 312	238 843	257 570	371 952
Romania	72 827	60 924	74 927	33 100	44 897
Russia	121 405	156 391	*160 000	*160 000	*160 000
Serbia	—	—	—	...	...
Serbia and Montenegro	3 045	180	...	—	—
Spain	563 580	552 507	650 061	696 912	700 000
Sweden	44 000	38 000	30 000	24 000	25 000
Turkey	3 250 000	4 600 000	4 750 000	5 500 000	6 000 000
Ukraine	...	48 800	63 930	67 313	76 305
United Kingdom (c)	1 309	2 274	1 835	1 441	*1 400
Algeria	...	...	43 872	65 615	83 208
Egypt (d)	*350 000	178 249	357 134	*360 000	*360 000
Morocco	*20 000	26 800	*31 000	*34 000	38 000
South Africa	57 738	53 721	56 574	76 722	90 312
Zimbabwe	816	79	—	—	...
Cuba	*7 000	10 515	8 020	5 500	5 600
Guatemala	9 320	4 473	3 808	17 176	10 480
Mexico	346 315	364 166	373 411	459 209	438 696
USA	800 000	770 000	750 000	760 000	*760 000
Argentina	90 857	125 684	151 307	170 728	*170 000
Brazil	102 077	280 293	196 419	166 418	182 168
Chile	6 690	4 838	5 820	5 847	6 704
Colombia	*100 000	*100 000	*100 000	*100 000	*100 000
Ecuador	44 268	53 469	38 249	67 844	*69 000
Peru	7 349	6 005	9 038	9 287	15 450
Uruguay	2 450	1 950	2 150	2 470	2 050
Venezuela	149 450	175 864	202 000	*200 000	*200 000
Burma	*10 000	*10 000	*10 000	*10 000	*10 000
China	*2 000 000	2 300 000	2 300 000	*2 300 000	*2 300 000
India (a)	332 220	379 055	426 498	373 414	405 299
Indonesia	*24 000	*24 000	*24 000	*25 000	*25 000
Iran (b)	293 370	248 710	286 033	411 807	...
Japan (e)	1 006 093	*889 000	*800 000	*800 000	*750 000
Jordan	13 057	13 063	1 000	11 054	*11 000
Korea, Republic of	477 012	541 788	508 644	427 378	398 513
Malaysia	42 662	79 220	117 180	142 358	358 585
Pakistan (d)	37 344	30 373	25 032	22 435	26 120
Philippines	34 546	32 106	11 853	15 176	14 837
Saudi Arabia	33 700	37 400	42 587	42 000	*42 000
Sri Lanka	32 586	38 600	45 492	56 864	46 583
Taiwan	510	900	—	—	—
Thailand	824 990	1 001 053	1 149 717	1 067 684	684 668
Uzbekistan	*4 300	*4 300	*4 300	*4 300	*4 300
Vietnam	*150 000	*180 000	*200 000	*200 000	*200 000
Australia (d)	118 115	108 073	95 362	*100 000	*105 000
World Total	16 048 000	19 031 000	19 710 000	21 371 000	22 492 000

Note(s):-
(1) In addition to the countries listed, Slovakia is believed to produce feldspar

(a) Years ended 31 March following that stated
(b) Years ended 20 March following that stated
(c) China stone
(d) Years ended 30 June of that stated
(e) Including weathered granite feldspar

FLUORSPAR

Characteristics

Fluorspar is the commercial name for the mineral fluorite (calcium fluoride, CaF_2). The pure form consists of 51.1 per cent calcium and 48.9 per cent fluorine. Fluorine represents an average 0.06 to 0.09 per cent of the Earth's crust and is mainly found occurring in fluorite. It is also found in small amounts in a wide variety of other minerals, such as apatite and phlogopite. Fluorite generally occurs as well-formed cubic crystals exhibiting a wide range of colours and usually contains mineral impurities such as calcite, quartz, barytes, celestite, various sulphides or phosphates. Commercial fluorspar is graded according to quality and specification into acid-grade (minimum 97 per cent CaF_2), metallurgical grade (minimum 80 per cent CaF_2) and ceramic grade (80–96 per cent CaF_2 and up to three per cent SiO_2).

Fluorspar is found in a wide range of geological environments on every continent. The primary economic source of fluorspar is in vein deposits (sheet-like bodies formed by minerals crystallising from aqueous solutions to fill fissures in rock) where it occurs as the main mineral or with metallic ores, in particular lead, zinc, silver and barytes. It also occurs as replacement deposits, replacing limestone or marble. In vein deposits fluorspar tends to occur as lenticular bodies, separated by barren areas. The mineralised veins vary considerably in width and length, usually being between 1 and 10 m wide and between 50 and 500 m long.

World reserves of fluorspar (measured as pure CaF_2) are 240 million tonnes, of which South Africa holds 41 million tonnes, Mexico 32 million tonnes and China 21 million tonnes (USGS, 2008).

Uses

The grade of fluorspar determines its end-use. Approximately 34 per cent of fluorspar produced worldwide is of metallurgical grade and is used primarily as a flux in steelmaking and in the production of aluminum. Ceramic grade fluorspar is used in the production of glass and ceramics as well as the manufacture of magnesium and calcium metal and accounts for a very limited amount of worldwide production. Around 65 per cent of fluorspar produced is acid-grade fluorspar; this is used in the production of hydrofluoric acid (HF), the basis for all fluorine-bearing compounds, which include important pharmaceuticals and agrochemicals. One of the largest uses of hydrofluoric acid was in the production of chlorofluorocarbons (CFCs) but CFC production in recent years has rapidly declined due to concern over the effect of the chlorine component in depleting the ozone. To some extent they have been replaced by hydrofluorocarbons (HFCs) although these are classed as 'greenhouse gases' and their use is strictly controlled. Acid grade fluorspar is also an important component in plastics manufacture. Fluoropolomyers such as Teflon® have high thermal stability, high chemical inertness, strong electrical insulation and a low coefficient of friction and so have many applications. A rapidly growing market is nitrogen trifluoride (NF_3) which is widely used as a cleaning gas in the manufacture of semiconductors and LCD screens.

World production in 2007

World production in 2007 remained constant compared to 2006 in contrast to the five to 10 per cent rises seen in recent years. There has been steady growth in fluorspar production since 2003, driven for the most part by increased Chinese consumption although decreases in European and Russian production in 2007 mean a much more modest rise in world production.

China continued its dominance of world fluorspar production with 57 per cent of total world production. Chinese production increased by seven per cent from 2006–2007 and has increased by 33 per cent in the last five years. The world's second largest producer, Mexico, showed a small production decrease in 2007 although production has risen by 23 per cent since 2003. After several years of very small increases South Africa, the world's third largest producer, increased production by nine per cent due to fluorspar producer Sallies increasing production from its Wiktop Mine.

European production decreased in 2007, with the largest producers Russia and Spain decreasing production by 14 and five per cent respectively. French production dropped to zero following the closure of mines due to depletion of reserves.

Prices

Over the last twelve months fluorspar prices in all grades have steadily increased, with the highest increases from July onwards. Prices for all grades finished the year on average 60 per cent higher then the equivalent period for 2007, continuing a steady pattern of growth since 2003. The high prices during 2008 where due to a shortfall in supply outside China and an increase in international freight costs (Tran, 2008). Mexican acidspar filtercake (f.o.b. Tampico), was priced at US$250–US$325 per tonne and Chinese acidspar filtercake (c.i.f. US Gulf Port) was priced at US$530–US$550 per tonne in December 2008 (Industrial Minerals, 2008c).

Industry events in 2007

The Chinese fluorspar industry has again dominated world industry events with Chinese exports of fluorspar continuing to fall. The Chinese Government continued their policy of restricting fluorspar exports, a policy which USA trade officials are considering challenging by filing a case against China to the World Trade Organisation claiming this violates WTO rules (Wan, 2008a). Despite the planned phase out of environmentally damaging fluorocarbons under the Kyoto Treaty, fluorocarbon production is still increasing and is predicted to grow up to 3.2 per cent until 2012 (Industrial Minerals, 2008b). This is due to a thriving refrigerant industry in China, India and other developing countries which are not under the same restrictions as developed countries.

The high prices and tight supply due to the actions of China has resulted in growth of the fluorspar industry in 2008 with new projects being planned and old projects re-visited. African miner CAMEC has unveiled plans to begin fluorspar extraction on its Doornhoek property, South Africa, adjacent to the existing Witkip Mine, owned by Sallies. Also in South Africa Sephaku Exploration has announced plans to fast track its Kromdraai fluorspar project which could produce between 50 000 and 250 000 tonnes per annum. Metorex increased fluorspar recovery by five per cent at its Vergenoeg plant, South Africa, and feasibility work was undertaken to increase production levels to 300 000 tons per annum to meet aluminium production demand (Industrial Minerals, 2008a).

The year 2008 seemed a more positive year for historically troubled South African fluorspar miner Sallies. Sallies started the year with a rights offer to repay some of its debts and provide funds for infrastructure improvement and, in the third

quarter of 2008, reported an operating profit as well as production increases for the Wiktop and Buffalo mines (Kruger, 2008).

The Australian company, Minemakers, continued to develop its Moina Project in Tasmania however future work is needed to ascertain whether the deposit can yield commercially acceptable fluorspar (Minemakers Limited, 2008).

A Swedish fluorspar project from the 1970s received renewed interest this year from UK mineral explorer Tertiary Minerals. After a drilling programme at the Stourman project, Sweden, Tertiary Minerals confirmed a potential ore reserve of 12.5 million tonnes of fluorspar at 13.3 per cent CaF_2 as well as significant additional resources grading 10.6 to 22.7 per cent CaF_2. Work continues at the site with the aim of bringing it into production (Wan, 2008b). The St Lawrence fluorspar mine, Canada, which closed in 1990 after the mine went bankrupt, also saw interest this year with Canadian companies Burin Fluorspar and Rivera Capital signing an agreement to re-open the mine (Moores, 2008).

Glebe Mines, a UK based fluorspar extractor, was successful this year in gaining planning permission for an extension to its existing quarry, allowing 660 000 tonnes of fluorspar to be extracted over a six-year period. A vital step for the mine as its current permissions only allowed operations until the end of 2008 (Wan, 2008c).

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Production of fluorspar

tonnes

Country	2003	2004	2005	2006	2007
France	90 000	70 000	53 000	*40 000	—
Germany	33 289	33 203	35 364	53 009	54 359
Italy	26 387	24 339	70 326	*15 000	—
Romania	*15 000	*15 000	—	—	—
Russia	*170 000	226 400	245 500	*210 000	*180 000
Spain	139 266	145 694	144 126	144 845	137 310
Turkey	718	880	800	*800	*900
United Kingdom	*56 000	50 080	56 417	49 676	44 936
Egypt	*500	891	549	*550	*550
Kenya (d)	80 201	117 986	109 594	132 030	85 115
Morocco	81 225	107 200	114 700	103 300	78 800
Namibia	79 281	104 785	114 886	132 249	*132 000
South Africa	235 000	264 900	265 600	270 000	*295 000
Mexico	756 258	842 698	875 450	936 433	933 361
Argentina	5 422	6 189	7 502	8 278	8 280
Brazil (a)	56 346	57 772	66 512	63 604	65 526
China	2 400 000	2 500 000	2 700 000	3 000 000	3 200 000
India (e)	12 393	14 008	5 577	2 785	3 583
Iran (b)	41 094	41 220	64 601	58 871	...
Korea, Dem. P.R. of	*12 000	*12 000	*12 500	*12 500	*12 500
Kyrgyzstan	3 973	*4 000	*4 000	*4 000	*4 000
Mongolia	198 400	354 900	367 500	377 000	372 500
Pakistan (c)	*1 000	1 026	*1 040	*1 050	*1 060
Thailand	2 360	2 375	295	3 240	1 820
Vietnam	*3 000	*4 000	*4 000	*4 000	*4 000
World Total	4 500 000	5 000 000	5 300 000	5 600 000	5 700 000

Note(s):-
(1) In addition to the countries listed, Bulgaria is believed to produce fluorspar
(2) In addition, the USA produced the following amounts of fluorspar equivalent in fluorosilicic acid derived from processing phosphate rock ('000 t): 2003: 94; 2004: 90; 2005: 86; 2006: 70; 2007: 83

(a) Including beneficiated and directly shipped material
(b) Years ended 20 March following that stated
(c) Years ended 30 June of that stated
(d) Exports
(e) Years ended 31 March following that stated

Production of germanium metal

tonnes

Country	2003	2004	2005	2006	2007
USA (a)	5	4	5	5	5
China	*30	*30	*35	*100	*100
Japan	1	1	2	2	1

Note(s):-
(1) Significant quantities of germanium are also believed to be recovered from imported or domestic material in France, Germany, Russia and to a lesser extent in Italy

(a) Including production of secondary metal

GOLD

Characteristics

Gold is a soft, malleable, bright yellow metallic element unaffected by air or most reagents. Gold occurs in its native state or in combination with other elements such as silver. Gold is highly valued as an asset or investment commodity and is extensively used in jewellery and for industrial applications.

Uses

Gold is a long-established, universally accepted store of value, widely traded internationally. Gold is seen as a safe haven in times of financial and political uncertainty since it is not at risk of becoming worthless, unlike currency and other assets. Gold is increasingly being used to diversify investment portfolios, as a currency and as a hedge against inflation. The centre of world gold trading is the London Bullion Market, on which the gold price is fixed twice daily. The fix is used as a benchmark for pricing the majority of gold products and derivatives throughout the world's markets. Jewellery production accounts for the largest use of gold, representing around 70 per cent of total demand (World Gold Council, 2006a). In Asia and the Middle East gold jewellery is commonly bought as an investment or store of value. Gold has a wide range of industrial uses, dominated by the electrical sector, in which it is valued for its excellent thermal and electrical properties. A significant amount of gold is consumed in dentistry and it also has medical applications. Research is continually finding new applications for gold including catalysts and in nanotechnology.

World production in 2007

Gold production is recorded in more than 80 countries and several countries produce substantial quantities of gold from small operations which are not recorded in official statistics. Eight countries produce more than a 100 000 kilograms (metal content) of gold annually, or 67 per cent of world mine production. World mine production, which had been rising for around 20 years, peaked in 2000 at 2560 tonnes. Annual mine production in 2007 was 2340 tonnes, a fall of 220 tonnes in seven years. High gold prices in the late 1970s and early 1980s resulted in steadily increasing global production to the peak in 2000. Production subsequently levelled out and began to decline reflecting the low gold price between 1997 and 2001, investor uncertainty resulting from the Bre-X scandal (a major mining fraud) and diminishing reserves. The depressed gold price led to a lack of exploration and development during this period, resulting in very few new discoveries and depletion of reserves. Following this period of declining exploration budgets, which reached a low in 2002, exploration expenditure began to increase in response to dwindling gold reserves, higher gold prices and increasing investor interest.

South Africa has dominated world gold production for many decades and in 1970 was producing over 1000 tonnes annually, equating to 60 per cent of world production. South African output has since been declining whilst many other countries have expanded production. The decline in South African gold production is attributed to the mature nature of the mines and declining reserves, high production costs and accidents. South Africa experienced a further seven percent fall in gold production from 272 tonnes in 2006 to 252 tonnes in 2007. In 2007 China became the world's largest gold producer, a position South Africa has held for more than one hundred years. China's gold production has increased dramatically in recent years, reaching 270 tonnes in 2007. China's gold production has increased by 29 per cent in the last five years and the Chinese Government has been highly supportive of gold exploration leading to a rapidly expanding resource base (Mining Journal, 2007). Other traditionally dominant gold producers, including Australia, USA and Canada, are rapidly losing ground to new producers who have become increasingly important in recent years. Australian gold output declined by one per cent in 2007, whilst the US and Canada both experienced a three per cent reduction in production. Indonesia has experienced an exceptional rise in production from only three tonnes in 1985 to 143 tonnes in 2005, largely from the giant Grasberg Mine (World Gold Council, 2006b). Notably Indonesian production fell by more than 57 tonnes in 2006 to 85 tonnes as a result of a sharp reduction in the ore grade at Grasberg (O'Connell, 2007a). Indonesian production has since recovered reaching 118 tonnes in 2007. Peru, which is now the world's fifth largest gold producer, has increased production from 24 tonnes in 1992 to more than 200 tonnes in recent years, thanks to new large-scale mines such as Yanacocha. However, Peruvian gold production declined to a four-year low in 2007 of 170 tonnes because of falling production at the Yanacocha Mine (Emery, 2007).

Prices

The gold market is characterised by substantial above-ground reserves, held mainly by banks. If some of these are released into the world market the gold price may be significantly affected. The gold price can be volatile but has strengthened in recent years due to declining mine output, increasing jewellery demand, extensive speculative activity and new gold investment products, devaluation of the US dollar (which underpins the gold price), lower interest rates and geopolitical tensions. All gold prices quoted are based on the London afternoon daily price, in US dollars per troy ounce, as quoted by Metal Bulletin (2009).

Following a period of depressed gold prices between 1987 and 1999, when the price of gold fell by 40 per cent, the gold market has significantly improved in recent years. Since 2001, the gold price has more than doubled, rising from an average annual price of US$271 per ounce to US$695 per ounce in 2007.

Continuing into 2008 the gold price remained extremely strong as the US dollar weakened against the Euro and the oil price exceeded $100 barrel for the first time in history (Metal Markets, 2008a). On the 3rd January the gold price reached its highest ever price of US$859 per ounce, exceeding the previous record of US$850 per ounce set in January 1980. The gold price continued to climb during January ending the month at US$923 per ounce. Prices during early February remained volatile before accelerating rapidly upwards to end the month at US$971 as the US dollar weakened to a record low against the Euro and inflation concerns grew as the oil price escalated (Metal Markets, 2008b; Metal Markets, 2008c). Prices continued to increase during March as a result of record oil prices and further weakening of the US dollar against the Euro (Metal Markets, 2008d). By the middle of March, the gold price had broken the US$1000 per ounce barrier continuing upwards to an all-time high of US$1011 per ounce on the 17th March. The record prices seen during the first quarter largely resulted from investors turning to gold as a safe haven during a period of market turmoil which saw the US dollar falling to record lows against the Euro and heavy losses in banking sector.

London afternoon daily gold price. Source: Metal Bulletin 2009 (w w w .metalbulletin.com)

The peak in the gold price was followed by a sharp correction ending March at US$933 per ounce. During early April prices fell considerably as the US dollar strengthened (Metal Markets, 2008d). Prices strengthened as the US dollar weakened and the oil price reached record levels (Metal Markets, 2008e). By the start of May prices had fallen 16 per cent since the all-time high in March. The price of oil and strength of the US dollar strongly influenced the gold price during May. The gold price fluctuated during June influenced by the strength of the US dollar, the oil price, and a decision to maintain US interest rates (Metal Markets, 2008f). The gold price fell in early July before climbing strongly to reach US$986 per ounce in mid July as the oil price rose and investors looked for a safe haven as tensions increased between the US and Iran (Metal Markets, 2008g).

The decline in the gold price during the second half of July continued into August as the US dollar strengthened against the Euro and oil prices declined (Metal Markets, 2008h). Prices recovered slightly before plummeting to an 11-month low of US$740 per ounce on the 11th September. The gold price quickly recovered as investors sought a safe haven during a period of intense market uncertainty associated with the collapse of a major investment bank. During early October the gold price responded to increased investment demand over banking concerns, as the credit crisis impacted on Europe and equity markets plunged (Metal Markets, 2008i,j). The gold price largely fell during the second half of October reaching US$712 per ounce as the US dollar strengthened reducing demand for commodities. The November gold price recovered from the decline in October as lower prices attracted investors back to gold, European interest rates were cut and an announcement was made by China on future spending plans. Gold ended November above US$800 per ounce as the US government stepped in to help the banking sector (Metal Markets, 2008k,l,m). The gold price fell during early December before climbing rapidly to US$827 as the US dollar weakened over concerns for the future of the US car making industry (Flood, 2008). Prices subsequently continued upwards driven by a weakening dollar before falling in response to a US interest rate cut. Tensions in the Middle East ensured at strong finish to the year with gold reaching US$880 per ounce, albeit a 13 per cent drop from the high of March.

Industry events in 2008

Dehedging, a process whereby producers settle forward sales obligations, has been a prominent feature of the gold market in recent years. Since 2000 the increasing difference between lower forward selling prices and rising spot gold prices has led to producers reducing their volume of forward sales (Berg, 2007; Pieterse, 2007). Dehedging, impacts on the spot market by effectively reducing the amount of global mine production available (Berg, 2007). Dehedging reached record levels in 2007 as mining companies sought to reduce their hedge books (Kruger, 2007). Dehedging continued during 2008 with an 18 per cent reduction in the global gold hedge book during the first quarter (Mineweb, 2008). Total dehedging for 2008 was estimated at 320 tonnes with the most significant dehedging coming from Anglogold Ashanti and Barrick Gold (Schultz, 2008). European central bank gold sales during the period 2007/2008 were 357.2 tonne of gold, considerably below the self-imposed limit of 500 tonnes per annum (Fortis, 2008).

A number of new mines were being developed or came on stream during 2008. Harmony continued with expansion plans at its Tshepong operations in South Africa which are planned to reach full production of 648 kg of gold a month in 2010 (Mining Review Africa, 2006). During 2008 the first gold was produced at GMA Resources Amesmessa Mine in Algeria (GMA Resources, 2008). Etruscan Resources poured its first gold at its Youga gold mine in Burkina Faso during 2008. The mine is projected to produce around 88 000 ounces of gold annually (Etruscan, 2008). During 2008 Gold Fields commissioned its new Cerro Corona gold–copper mine in Peru and the first concentrate shipment is planned for 2009 (Your Mining News, 2008; Gold Fields, 2008). Gold Resource Corporation has commenced development at its El Aguila project in Mexico (Gold Resource Corporation, 2008). In Europe Gold Ore Resources announced increased production

at its Swedish Bjorkdal Mine as a result of processing higher grade ore and Lappland Goldminers commenced production at its Pahtavaara gold mine in Finland (Gold Ore Resource, 2008; Lapland Goldminers, 2008).

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Mine production of gold

kilograms (metal content)

Country	2003	2004	2005	2006	2007
Armenia	1 800	2 112	1 373	867	565
Bulgaria	2 270	2 431	3 868	3 818	3 964
Finland	*1 200	*1 300	*1 300	*1 300	*1 700
France	1 470	—	—	—	—
Georgia	2 386	1 377	1 620	2 400	3 100
Greenland	—	1 560	1 828	2 324	2 396
Italy	*100	—	—	—	—
Poland (d)	356	527	713	1 700	891
Romania	1 878	1 430	*500	*500	*500
Russia	170 068	169 297	163 186	159 340	156 912
Serbia (d)	—	—	—	*330	*330
Serbia and Montenegro (d)	363	328	*330	—	—
Slovakia	79	107	109	84	92
Spain	5 417	5 248	2 145	1 565	—
Sweden	5 900	6 564	6 564	6 848	5 159
Turkey	5 370	3 260	—	2 205	4 208
Algeria	365	597	641	377	236
Botswana	9	162	2 709	2 547	2 722
Burkina Faso	780	1 008	1 397	1 571	*2 000
Burundi	2 855	3 229	3 905	4 313	2 423
Cameroon	700	600	600	*600	*600
Congo, Democratic Republic	*8 900	*10 500	*9 000	*10 000	*10 000
Ethiopia (b)	3 875	3 490	3 726	3 828	*3 300
Gabon	*70	300	*300	*300	*300
Ghana	70 756	63 140	66 530	72 323	83 558
Guinea	16 631	15 593	18 013	16 336	15 688
Ivory Coast	1 313	1 219	1 638	1 323	1 243
Kenya (e)	1 543	567	616	432	3 023
Mali	45 529	37 916	44 156	58 382	52 753
Mauritania	...	...	...	322	2 332
Morocco (d)	1 863	1 493	*1 500	*1 500	*1 500
Namibia	2 508	2 205	2 649	2 790	*2 600
Niger	34	1 590	4 962	2 615	2 625
Senegal	*600	*600	*600	*600	*600
Sierra Leone	—	20	21	82	216
South Africa	372 766	337 223	294 803	272 128	252 345
Sudan	*5 500	4 239	4 739	3 246	2 701
Tanzania	48 018	48 176	47 270	39 750	40 193
Togo	...	...	6 179	7 184	10 159
Uganda (e)	4 160	1 447	1 500	2 192	2 543
Zambia (c)	*140	*160	*170	*180	...
Zimbabwe	11 514	21 330	13 453	11 354	6 750
Canada	141 589	130 727	120 541	104 448	101 712
Costa Rica	*110	*150	540	1 780	940
Cuba	547	—	—	—	—
Guatemala	4 550	—	741	5 036	7 100
Honduras	4 494	3 683	4 439	4 055	3 012
Jamaica	146	20	—	—	—
Mexico	20 406	21 818	26 782	35 899	39 355
Nicaragua	3 096	4 064	3 674	3 395	3 330
USA	276 897	257 905	255 757	251 853	244 000
Argentina	29 748	28 496	27 904	44 131	42 021
Bolivia	9 361	6 165	8 871	9 628	8 818
Brazil	40 416	47 596	38 293	40 075	49 600
Chile	38 954	39 986	40 447	42 100	41 527
Colombia	46 515	37 738	35 783	15 683	15 483
Ecuador	4 819	5 128	5 228	5 338	3 186
French Guiana	3 296	2 773	1 955	*2 000	*2 000
Guyana	12 171	11 478	5 668	6 405	7 412
Peru	172 619	173 219	207 822	202 822	170 128
Suriname	—	8 513	10 619	10 426	8 585
Uruguay	1 550	1 758	2 930	*2 800	3 172
Venezuela	8 190	9 690	*10 000	*13 200	*9 500

Mine production of gold

kilograms (metal content)

Country	2003	2004	2005	2006	2007
Burma (d)	*100	*100	*100	*100	*100
China (d)	210 100	212 350	255 000	247 500	270 490
India (a)	3 457	3 526	3 047	2 490	2 836
Indonesia	141 019	92 936	143 205	85 411	117 854
Iran (d)	*500	*900	275	850	*850
Japan	8 122	7 936	8 319	8 904	8 869
Kazakhstan (d)	*19 000	*19 000	*18 000	22 564	21 824
Korea, Republic of	528	233	260	277	162
Kyrgyzstan	22 476	21 395	16 751	10 301	10 572
Laos	5 140	4 392	6 338	6 068	4 161
Malaysia	4 739	4 221	4 250	3 496	2 913
Mongolia	11 119	19 418	24 122	21 267	18 087
Oman	4	192	350	144	*100
Philippines	37 844	35 464	37 490	36 141	38 792
Saudi Arabia	8 500	8 268	7 456	5 182	4 441
Tajikistan	2 370	2 161	1 927	1 920	*1 920
Thailand	4 269	4 507	4 393	3 470	3 401
Uzbekistan	84 610	88 350	84 210	76 620	72 850
Vietnam	*2 000	*2 000	*3 000	*3 000	*3 000
Australia	282 000	259 000	263 000	247 000	245 000
Fiji	3 517	4 033	2 793	1 403	29
New Zealand	9 305	10 151	10 583	10 618	10 762
Papua New Guinea	67 832	73 500	68 200	58 349	57 747
World Total	2 550 000	2 420 000	2 490 000	2 350 000	2 340 000

Note(s):-
(1) In several countries substantial amounts of gold produced in small operations are not recorded in the official statistics used when compiling this table
(2) In addition to the countries listed, Benin, Central African Republic, Congo, Eritrea, Liberia, Mozambique, Nigeria, Solomon Islands, Taiwan and Ukraine produce less than 100 kg gold per year
(3) Greece and Norway are believed to produce gold

(a) Years ended 31 March following that stated
(b) Years ended 7 July of that stated
(c) Contained in blister copper, refinery muds and electrolytic copper
(d) Metal production
(e) Exports

Production of graphite

tonnes

Country	2003	2004	2005	2006	2007
Czech Republic	9 000	5 000	3 000	5 000	3 000
Germany	2 840	3 155	2 638	—	—
Norway	1 000	6 000	9 000	9 000	3 000
Romania	1 014	395	486	—	—
Russia	12 780	13 550	*14 000	*14 000	*14 000
Turkey	942	*1 000	*1 100	*1 200	*1 200
Ukraine	11 000	10 960	10 400	5 800	...
Madagascar	2 170	7 770	6 400	4 857	*5 000
Zimbabwe	6 280	10 267	4 298	6 588	*6 600
Canada	12 500	*15 000	*17 000	15 000	15 000
Mexico	8 730	14 769	12 357	11 773	9 900
Brazil (b)	70 739	76 332	75 515	76 194	77 163
China (d)	1 400 000	1 450 000	1 650 000	1 730 000	1 800 000
India (a) (c)	87 207	108 150	125 651	124 389	115 511
Korea, Dem. P.R. of	*25 000	*30 000	*30 000	*30 000	*30 000
Korea, Republic of	58	247	39	68	52
Sri Lanka	3 387	5 374	4 370	5 756	9 593
World Total	1 700 000	1 800 000	2 000 000	2 000 000	2 100 000

Note(s):-
(1) This table includes all forms of amorphous and crystalline graphite but excludes synthetic material
(2) In addition to the countries listed, Egypt, Namibia and the USA are believed to produce graphite

(a) Crude
(b) Including beneficiated and directly shipped material
(c) Years ended 31 March following that stated
(d) Including flake graphite

Production of gypsum

tonnes

Country	2003	2004	2005	2006	2007
Armenia	57 835	...	...	...	...
Austria					
Gypsum	889 727	920 809	911 162	936 072	1 006 416
Anhydrite	113 823	117 318	106 032	135 380	57 428
Azerbaijan	3 848	884	28 242	35 034	22 037
Bosnia & Herzegovina	143 047	139 520	152 939	131 936	145 833
Bulgaria	165 500	175 900	187 700	215 800	234 300
Croatia	166 340	193 263	196 133	170 351	170 721
Cyprus	300 000	255 000	215 500	270 000	330 000
Czech Republic	76 000	68 000	24 000	19 000	66 000
France	*5 600 000	*5 700 000	4 902 498	*4 800 000	*4 800 000
Georgia	8 507	1 707	238	123	...
Germany (a)	1 748 000	1 579 000	1 644 000	1 771 000	1 898 000
Greece	731 785	856 606	865 216	*860 000	*860 000
Hungary (a)	62 000	55 000	19 000	30 000	26 000
Ireland, Republic of	*600 000	*650 000	*700 000	*700 000	*700 000
Italy	1 783 903	1 615 287	*1 600 000	1 600 000	*1 600 000
Latvia (a)	159 133	225 742	*220 000	*230 000	*230 000
Macedonia	150 618	165 416	190 232	267 760	255 500
Moldova	116 100	491 000	562 700	725 900	846 400
Poland					
Gypsum	1 030 693	970 786	1 048 000	1 172 000	(a) 1 581 299
Anhydrite	197 000	196 000	195 000	181 000	...
Portugal	419 799	461 212	389 180	366 599	...
Romania	409 516	490 372	532 867	615 072	706 704
Russia	1 766 600	2 076 800	*2 200 000	*2 200 000	*2 400 000
Serbia	—	—	—	*42 000	*42 000
Serbia and Montenegro	42 261	42 471	*42 000	—	—
Slovakia (a)	93 800	127 100	107 500	126 200	151 000
Spain	11 366 375	12 533 972	14 453 053	14 596 559	14 000 000
Switzerland	*300 000	*300 000	*300 000	*300 000	*300 000
Turkey	196 668	250 099	*250 000	*250 000	*250 000
Ukraine	461 000	601 000	656 000	375 900	741 580
United Kingdom	*1 700 000	1 686 000	*1 700 000	*1 700 000	*1 700 000
Algeria	*800 000	467 352	857 502	1 033 107	1 198 303
Egypt	7 920 000	7 634 000	3 290 000	*3 300 000	*3 300 000
Eritrea	2 705	1 054	212	396	548
Ethiopia (d)	48 058	51 200	34 729	38 809	*39 000
Kenya	*8 700	*8 900	*9 100	*9 100	*9 100
Libya	*150 000	*175 000	*175 000	*175 000	*175 000
Madagascar	286	500	500	500	500
Mauritania	*40 000	*40 000	43 266	45 222	49 229
Morocco	*600 000	*600 000	*600 000	*600 000	*600 000
Niger	17 851	34 944	17 417	13 043	4 615
Somalia	*1 500	*1 500	*1 500	*1 500	*1 500
South Africa	394 069	452 271	547 581	554 020	643 630
Sudan	*5 000	*5 000	*5 000	7 000	7 974
Tanzania	33 232	59 231	63 377	32 798	2 730
Tunisia	*100 000	109 000	113 000	151 000	157 000
Canada (a)	8 925 000	9 205 000	8 272 000	9 072 000	7 638 000
Cuba	99 500	84 800	73 100	72 500	80 200
Dominican Republic	219 311	435 723	352 242	238 429	*200 000
El Salvador	*6 000	*6 000	*6 000	*6 000	*6 000
Guatemala	66 981	106 140	349 589	226 800	495 335
Honduras	*60 000	*60 000	*60 000	*60 000	*60 000
Jamaica	248 558	283 352	302 066	364 432	227 697
Mexico	6 986 491	9 221 458	6 251 969	6 075 893	6 918 973
Nicaragua	30 642	36 466	36 456	42 191	43 300
USA	16 700 000	17 200 000	21 100 000	21 100 000	*22 000 000
Argentina	387 936	674 935	1 073 286	1 202 812	1 227 000
Brazil	1 529 015	1 474 911	1 582 248	1 711 671	1 923 119
Chile	662 259	630 444	660 753	845 331	773 119

Production of gypsum

tonnes

Country	2003	2004	2005	2006	2007
Colombia	*560 000	*560 000	*560 000	*560 000	*560 000
Ecuador	5 203	232	1 310	1 478	*1 500
Paraguay	*4 500	*4 500	*4 500	*4 500	*4 500
Peru	136 642	432 259	334 595	394 289	334 688
Venezuela	5 000	4 000	6 000	*7 000	*7 000
Afghanistan	*3 000	*3 000	*2 000	*2 000	*2 000
Bhutan	122 829	131 236	150 585	204 198	189 198
Burma (f)	66 069	71 155	67 522	*67 000	*67 000
China	27 500 000	29 520 000	32 000 000	35 000 000	*35 000 000
India (e) (f)	2 793 553	3 689 927	3 291 478	2 888 502	2 638 000
Indonesia	6 000	6 000	*6 000	*6 000	*6 000
Iran (c)	11 979 513	14 394 537	11 195 745	10 761 107	*11 000 000
Israel	141 000	124 678	106 798	110 754	82 974
Jordan	63 895	135 331	344 911	333 710	*340 000
Kazakhstan	...	396 200	516 600	649 400	653 600
Laos	101 727	201 094	131 508	*150 000	*290 000
Mongolia	*25 000	30 050	81 223	60 400	*60 000
Oman	*50 000	*60 000	*60 000	*60 000	...
Pakistan (b)	424 107	467 065	552 496	601 027	624 120
Saudi Arabia	491 132	*500 000	*500 000	563 558	*500 000
Syria	376 715	431 561	467 000	443 800	447 900
Tajikistan	50 100	57 000	8 500	...	...
Thailand					
Gypsum	7 291 167	7 619 205	7 113 073	8 354 901	8 643 391
Anhydrite	448 071	531 660	537 781	560 339	692 877
Uzbekistan	*80 000	*80 000	*80 000	*80 000	*80 000
Vietnam	*5 000	*5 000	*5 000	*5 000	*5 000
Yemen, Republic of	46 000	60 000	72 000	81 000	*90 000
Australia (b)	4 066 000	4 325 100	3 881 600	4 249 300	3 864 000
World Total	134 100 000	145 900 000	142 400 000	148 000 000	149 700 000

Note(s):-
(1) Some countries produce large quantities of synthetic gypsum. Where possible, this output is excluded from the table

(a) Including anhydrite
(b) Years ended 30 June of that stated
(c) Years ended 20 March following that stated
(d) Years ended 7 July of that stated
(e) Including selenite
(f) Years ended 31 March following that stated

Production of iodine

kilograms

Country	2003	2004	2005	2006	2007
Azerbaijan	—	—	—	—	21 000
Russia	58 000	105 000	*105 000	*105 000	*105 000
USA	1 090 000	1 130 000	1 570 000	*1 220 000	*1 200 000
Chile	13 916 000	14 931 000	15 346 000	16 494 000	15 473 000
China	*500 000	*550 000	*550 000	*560 000	*570 000
Indonesia	*75 000	*75 000	*75 000	*75 000	*75 000
Japan	6 524 000	7 264 000	8 095 000	8 724 000	*8 700 000
Turkmenistan	*200 000	*250 000	*270 000	*270 000	*270 000
Uzbekistan	*2 000	*2 000	*2 000	*2 000	*2 000
World Total	22 400 000	24 300 000	26 000 000	27 500 000	26 400 000

IRON ORE

Characteristics

The pure form of iron is a lustrous silver metal with a greyish tinge. It readily oxidises in air and is only very rarely found as native metal. As a ferromagnetic element it has magnetic properties. Iron is abundant (around five per cent) in the Earth's crust and its minerals vary greatly in their composition and appearance. The most common ore minerals are the oxides which can vary in colour from grey to yellow or red; particularly magnetite (Fe_3O_4) and hematite (Fe_2O_3). Other common ores include the hydrated oxides, goethite (FeO(OH)) and limonite ($FeO(OH)\cdot nH_2O$), and the carbonate mineral siderite ($FeCO_3$). The most economically important iron ore deposits are known as banded iron formations (BIF). These are found in Proterozoic rocks (2500–524 million years old) formed by deposition of iron oxides on the sea bed in an ancient reducing environment. The largest examples are from the Hamersley Province, Western Australia and the Lake Superior District, USA. Economic deposits are usually those that have been secondarily enriched by natural processes to grades of around 65 per cent iron. Magmatic deposits can also be the source of large quantities of magnetite where the mineral is segregated in a large magma chamber; the largest magmatic iron ore deposit is at Kiruna in Sweden. World reserves of iron ore are 150 000 million tonnes of ore containing 73 million tonnes of iron. Ukraine holds the worlds largest reserves of ore with 30 000 million tonnes (19 per cent of the world total). Russia is the second largest and China the third with 25 000 and 21 000 tonnes respectively (USGS, 2008).

Uses

Around 98 per cent of iron ore is used to make steel and goes directly to primary steel plants. The ore is first smelted to iron, known as pig iron, before it is processed into steel. The iron product can be in the form of blast furnace iron (BFI) where the ore is smelted with limestone and coke to produce liquid iron or direct reduced iron (DRI). Here the ore is heated and reduced using natural gas to produce iron pellets. Scrap iron and steel is melted in an electric arc furnace. To produce steel, liquid iron is treated in a converter to reduce its carbon content and adjust the alloy composition. Steel has numerous varied uses and, depending on the alloy, many different properties. The most common steel alloys are plain-carbon steel (up to 2.1 per cent carbon), stainless steel (alloyed with chromium and nickel), high-strength low-alloy steel (HSLA) with low levels of carbon, and tool steel, which is very hard due to heat treatment.

Pig iron can also be remelted, reducing the carbon and silicon contents, to produce cast iron; this is more brittle then steel but is suitable for many engineering uses such as machine and car parts (such as engine blocks), street furniture, and pipes.

The remaining two per cent has many other minor uses including use as a pigment, as an additive to cement, as magnets, in industrial processes, an ingredient in fertilisers, in catalysts or as a radioactive tracer for use in medicine or biochemical research.

World production in 2007

World production of iron ore rose to 2042 million tonnes in 2007, a 12 per cent increase on 2006. Increase in production was driven by high demand from China and, to a lesser extent, India. The consequent price increases have led to operators increasing production capacity and investing in new mines. Production still struggles to catch up with world demand. The year 2007 saw the highest iron ore production rates ever recorded for the sixth consecutive year, with production rising by 65 per cent since 2003. China was once again the world's highest producer with a 20 per cent increase in production, increasing by 171 per cent in the last five years. This increase has mainly been achieved by heavy investment at existing operations by big companies and a very fast expansion by small producers as well as technological breakthroughs leading to the development of new low grade mines. However year-on-year growth is down, from around 40 per cent in the previous two years, due to new environmental regulations from the Chinese government leading to the phasing out of many smaller less efficient operations. Brazil, the world's second largest producer, increased production by 12 per cent, mainly due to a record year of production by Vale, the country's biggest producer and capacity increases from the MMX-owned Corumba and Minas-Rio iron ore developments.

Australia, the world's third largest producer, increased its production by nine per cent in 2007 compared to 2006; this compares to an increase of five per cent between 2005 and 2006. This was due to the completion, by Rio Tinto, of projects at Hammersley's Mount Tom Mine and Yandicoogina Mine along with associated infrastructure and port facilities. BHP Billiton also completed capacity increases.

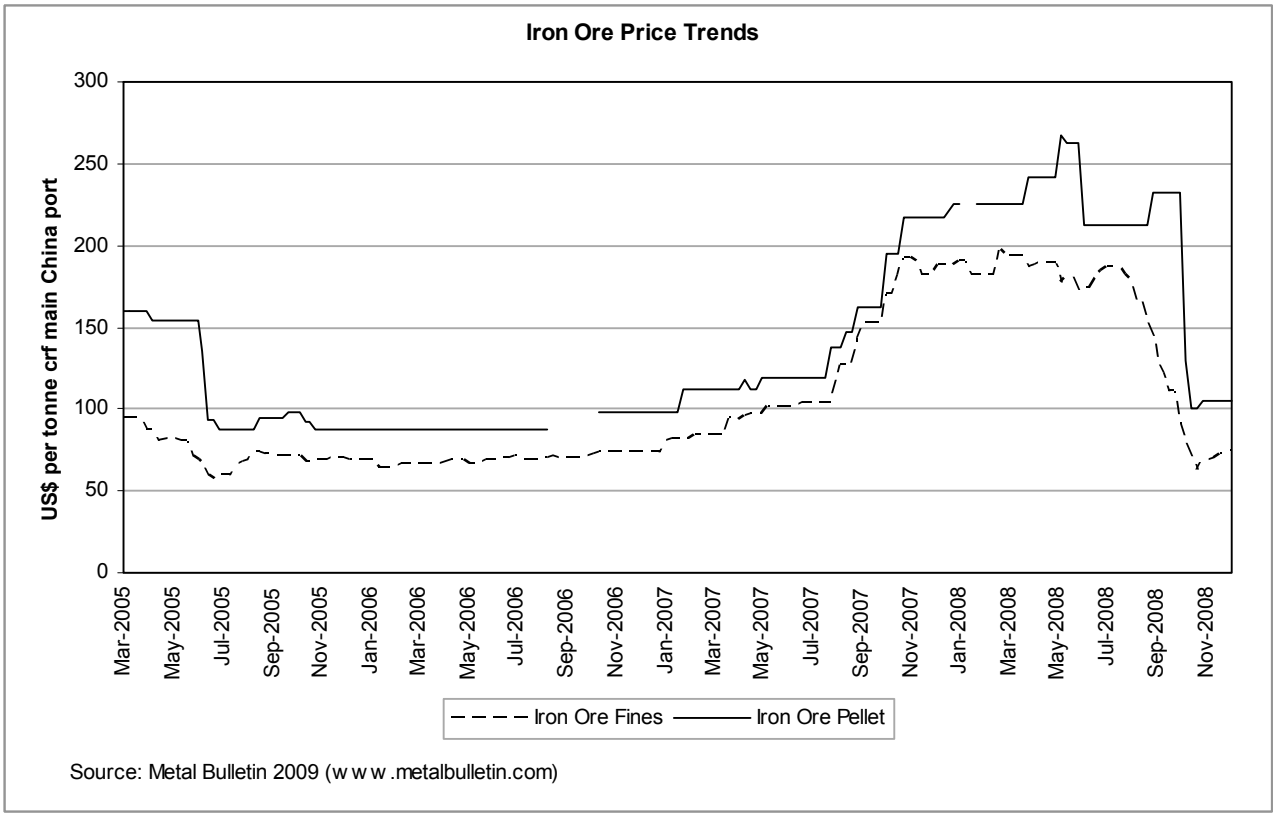
Only modest increases were seen in African production. In South Africa, the world's eighth largest producer, production rose by two per cent compared to 2006. This figure was mirrored by most other African producers.

The growth in European production was below the world average with a four per cent increase from 2006 to 2007, due to no major new investment and increased competition from Russia and Ukraine. Some Russian iron ore capacity increases, controlled by the major steel mills came on-stream in 2007 causing a seven per cent increase on 2006 production.

Production in the USA, the world's seventh largest producer, fell by one per cent continuing a trend over the last four years. Canada's iron ore production also decreased dropping year on year by one per cent.

Prices

Iron ore trade is characterised by consumers having fixed contracts with producers negotiated annually. Rarely will iron ore be traded with spot prices on the open market, although record prices and price volatility at the start of this year saw a move for sellers to sell more ore on the sport market. International commodities exchanges have also expressed a possibility of changing the benchmark price-led system to a futures price-led system (Lovesey,2008). Some miners even stated an intention to scrap contracts altogether, this situation changed with a sudden drop in prices in the second half of the year, with benchmark prices falling below contract prices for the first time since 2003. The price of iron ore remained relatively constant for the last three years and has sharply risen from the first half of 2007, remaining high until around September of 2008 then dropping back to 2006 levels or lower. This price rise, mainly driven by Chinese demand, led to record contact prices, with contract prices increasing between 60–97 per cent compared to 2007 prices, up to US$145 per unit for fines (Haycock, 2008a). These large price increases lead to some issues between miners and steelmakers, resulting in China looking more to domestic ore, and disagreements over freight costs.



Source: Metal Bulletin 2009 (w w w .metalbulletin.com)

Industry events in 2008

The Iron ore industry has had a year of two very different halves, with the period of January to September seeing record contract prices, plans to greatly increase production and large-scale investment in iron ore. However from late September onwards demand has decreased and the price has rapidly dropped which has caused production cuts and mine closures.

Record contract prices and positive forecasts for iron ore at the start of the year saw all the major producers make big plans for large-scale production increases. Rio Tinto started the year with a quarterly iron ore production increase of 11 per cent (Seatter, 2008) and announced plans to invest US$475 million into its iron ore operations in Canada, raising its Canadian production levels to 22 million tones of concentrate per annum (Haycock,2008b). Rio Tinto then further augmented its ramp-up of iron ore production in May with plans to produce more then 350 tonnes of ore by 2012 via expansion of infrastructure in the Pilbara costing US$667 million and development of the Simandou Mine, Guinea (Smith, 2008) (Rio Tinto, 2008). Rio's expansion plans continued to grow into July when the company unveiled a 2.15 billion program to expand iron ore capacity by 500 per cent at its Corumba operation in Brazil (Dudley,2008a).

BHP Billiton also announced approval for a US$1.09 billion in extra funding for infrastructure developments for its Australian iron ore operations with the aim of increasing its Western Australian iron ore capacity to 200 million tonnes per annum by 2011 (Jacoby, 2008a). Brazilian Iron ore major Vale continued the trend of big spending with the announcement of US$4.4 billion expansion programme for its iron ore business with the aim of increasing its output by 50 per cent, up to 450 million tonnes per annum by 2013 (Onstad, 2008).

This situation was entirely reversed however in the final quarter of the year as rapidly decreasing prices and market oversupply saw major producers cut output in an effort to reduce stockpiles. Rio Tinto announced plans to cut iron ore shipments by up to 20 tonnes and reduced its production targets by 10 per cent blaming a lack of demand from China's steel industry (Regan, 2008). There has also been speculation that Rio Tinto could call off its development of the massive Simandou iron ore project in Guinea which received further bad news in December when the Guinean government revoked the concession for the northern half of the project (Dudley, 2008b). Vale also reacted to decreasing steel demand by shutting four of its pellet plants and two of its Brazilian iron ore mines (Welch, 2008; Haycock, 2008c) resulting in 1 300 workers being made unemployed and another 5 500 being placed on paid leave (Miningnews.net, 2008a). BHP Billiton bucked this trend by giving the go-ahead for a US$4.8 billion investment into Pilbara iron ore operations, stating the long-term outlook was still good.

The downturn in the iron ore market contributed towards the halting of what could have been one of the largest mining takeovers of all time; BHP Billiton's bid to take over Rio Tinto to create the largest iron ore miner in the world. BHP Billiton attributed the bids failure to a combination of low metal prices and demand as well as requirements from the European Union's Competition Commission for the combined company to shed some of its iron ore and metallurgical coal assets.

The large amounts of steel needed for the rapid growth of China and India has been the major driver for iron ore industry merger and acquisitions. Chinese and Indian steel mills invested heavily in iron ore producers, trying to secure iron ore supplies when there were concerns over tight markets at the beginning of the year. Chinese steel manufacturer, Western Metals, purchased a 10 per cent stake in FerrAus, an Australian iron ore explorer (Miningnews.net, 2008b), Chinese steel company Shougnag Holding purchased a 19.9 per cent stake in explorer Prosperity resources (Dudley,

2008c) and Sinosteel took majority control of Australian iron ore producer Midwest (Jacoby, 2008b). China Metallurgical Group Corporation purchased the Cape Lambert iron ore project in the Pilbara for US$400 (Jacoby, 2008c) although days later the Russian steel company Evraz gained control of the project with an agreement with MMC to pay 75 per cent of the cost of the development (Haycock, 2008c). In an effort to secure long-term iron ore supplies Baosteel signed a contract with BHP Billiton, who agreed to supply 10 million tonnes of ore over a 10-year period (Lawson, 2008),

Vale set new records for the largest ever iron ore supply deal with a contract with Indian steel makers, ArelorMittal, to supply 480 million tonnes over a 10-year period (Haycock, 2008e). ArelorMittal also invested heavily in its West African operations, expanding its mining operations and exerting control over the iron ore industries of Mauritania, Senegal and Liberia (Mukumbira, 2008). Meanwhile Tata Steel, ArelorMittal's rival, expressed an interest in purchasing an iron ore mine in Western Australia (Miningnews.net, 2008c). Brazil also saw foreign investment as a consortium of six Japanese and Korean steelmakers acquired 40 per cent of Brazilian iron ore minor, National Minerals, with a US$3.1 billion investment (Kosich, 2008).

Again this situation reversed in the last quarter of the year with many Chinese steel producers deferring on there contracts due to production cuts, BHP Billiton announced they were reducing their sales of ore by six million tonnes after request from Chinese steel mills costing the miner around US$600 million (Miningnews.net, 2008d). The last quarter of 2008 also saw Chinese owned Shandong Iron and Steel group pull out of talks to purchase a Chilean iron ore miner for potentially hundreds of millions of dollars stating that ore supplies are now considered ample (Mineweb.com, 2008).

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Production of iron ore

tonnes

Country	2003	2004	2005	2006	2007
Austria (a)	2 124 787	1 889 419	2 047 950	2 091 995	2 152 825
Azerbaijan	3 100	19 100	7 300	11 300	17 600
Bosnia & Herzegovina	126 929	280 596	3 045 654	3 439 587	2 943 963
Bulgaria	466 100	82 700	—	—	—
Germany (b) (f)	429 170	412 238	362 106	416 000	421 700
Norway	410 000	586 100	713 000	620 000	630 000
Romania	244 000	231 417	220 788	122 684	...
Russia	92 604 600	94 894 600	96 828 000	103 900 000	105 000 000
Slovakia	287 000	305 072	258 500	311 000	349 000
Spain	571	10 879	—	—	—
Sweden	21 498 000	22 272 000	23 255 000	23 302 000	24 714 000
Turkey	3 429 070	3 856 536	3 889 934	3 251 969	3 538 917
Ukraine	62 500 000	66 000 000	69 456 000	74 000 000	77 900 000
United Kingdom	*500	*500	354	341	*300
Algeria	1 426 200	1 754 300	1 878 800	2 339 637	1 982 101
Egypt (d)	*2 900 000	2 237 475	1 599 000	*1 600 000	*1 600 000
Mauritania	10 153 000	10 674 000	10 752 000	11 155 000	11 815 000
Morocco	4 019	12 200	16 300	35 500	48 000
Nigeria	8 635	8 479	8 479	8 818	9 000
South Africa (c)	38 085 855	39 322 048	39 542 072	41 326 036	42 100 887
Tunisia	160 300	256 000	206 400	217 300	180 600
Zimbabwe	411 044	228 731	224 229	104 459	*104 000
Canada (g)	33 013 000	28 596 000	28 343 000	34 094 000	33 158 000
Cuba	18 400	19 700	18 900	7 800	3 300
Mexico	12 398 000	13 369 000	14 468 000	14 568 000	16 453 000
USA	48 554 000	54 724 000	54 300 000	52 700 000	52 000 000
Brazil	234 478 000	261 696 128	281 462 088	317 800 229	354 674 378
Chile	8 011 023	8 003 491	7 862 000	8 629 000	8 817 700
Colombia	625 002	507 711	607 559	644 015	623 930
Peru	5 228 804	5 228 800	5 614 900	5 885 000	6 277 000
Venezuela	17 954 495	19 196 231	21 179 000	22 100 000	*23 000 000
Bhutan	—	—	5 679	*5 300	...
China	261 084 600	310 104 800	420 492 700	588 171 400	707 073 000
India (h)	122 838 000	145 942 000	165 230 000	180 917 000	204 185 000
Indonesia	245 409	89 664	32 203	5 489	—
Iran (e)	18 287 228	18 204 658	26 243 837	31 537 545	*35 000 000
Kazakhstan	19 364 600	20 302 500	19 471 100	18 254 900	19 582 200
Korea, Dem. P.R. of	*1 100 000	*1 100 000	*1 200 000	*1 200 000	*1 200 000
Korea, Republic of	174 009	226 287	212 971	227 437	290 802
Malaysia (g)	596 612	663 732	949 605	667 082	802 030
Mongolia	—	33 498	167 700	180 000	*100 000
Pakistan (d)	11 773	84 946	104 278	131 259	125 879
Saudi Arabia	...	...	...	584 000	...
Thailand	9 675	135 580	230 946	264 289	1 554 860
Vietnam	711 900	1 205 400	1 435 000	*1 500 000	*1 500 000
Australia	212 881 000	234 002 000	261 796 000	275 042 000	299 009 000
New Zealand	1 946 913	2 329 417	2 207 244	2 146 496	1 723 726
World Total	1 237 000 000	1 372 000 000	1 569 000 000	1 826 000 000	2 043 000 000

Note(s):-
(a) Including micaceous iron oxide
(b) Used as aggregate in the construction industry
(c) Including by-product magnetite
(d) Years ended 30 June of that stated
(e) Years ended 20 March following that stated
(f) Including manganiferous iron ore
(g) Including by-product iron ore
(h) Years ended 31 March following that stated

Production of pig iron

tonnes

Country	2003	2004	2005	2006	2007
Austria	4 676 742	4 846 740	5 444 000	5 547 000	5 808 000
Belgium	7 812 593	8 224 000	7 254 000	7 516 000	6 577 000
Bosnia & Herzegovina	*60 000	*60 000	*60 000	*60 000	*60 000
Bulgaria	1 386 000	1 200 000	1 100 000	1 100 000	1 100 000
Czech Republic	5 207 000	5 385 000	4 627 000	5 192 000	5 287 000
Finland	3 092 051	3 036 566	3 056 165	3 157 894	2 915 130
France	12 615 893	13 087 705	12 595 584	12 873 900	12 327 637
Germany	30 071 000	30 628 000	29 294 000	30 940 000	31 700 000
Hungary	1 332 000	1 350 000	1 329 000	1 336 000	1 393 655
Italy	10 123 000	10 566 000	11 392 000	11 500 000	11 100 000
Netherlands	5 846 000	6 011 000	6 031 000	5 417 000	6 400 000
Norway	*110 000	*100 000	*100 000	*100 000	*100 000
Poland	5 585 094	6 292 341	4 476 831	5 332 632	5 804 418
Romania	4 101 409	4 243 956	4 097 998	3 945 975	3 923 234
Russia	51 235 000	53 461 000	51 750 000	55 022 000	51 043 000
Serbia	—	—	—	1 529 177	1 485 000
Serbia and Montenegro	635 182	959 019	1 115 195	—	—
Slovakia	3 892 000	3 765 000	3 681 000	4 145 000	4 012 000
Spain	3 645 000	4 036 000	4 160 000	3 432 000	4 400 000
Sweden	3 816 000	3 992 000	3 844 000	3 701 000	3 947 000
Switzerland	*80 000	*80 000	*80 000	*80 000	*80 000
Turkey	5 693 764	5 835 889	5 398 500	2 846 280	6 235 000
Ukraine	29 574 000	31 000 000	31 700 000	32 900 000	35 600 000
United Kingdom	10 277 800	10 179 600	10 188 800	10 695 700	10 958 800
Algeria	1 026 200	692 800	791 400	1 093 000	1 193 000
Egypt	3 950 000	*4 000 000	4 000 000	*4 200 000	*3 786 000
Libya	1 336 000	1 586 000	1 700 000	1 633 000	*1 660 000
Morocco	15 000	15 000	15 000	*15 000	—
South Africa	7 776 000	7 644 000	7 900 000	7 913 000	5 358 000
Tunisia	35 800	—	—	—	—
Zimbabwe	182 000	145 000	*145 000	38 000	*45 000
Canada	9 058 000	9 919 000	8 865 000	8 751 000	9 621 000
Mexico	9 656 634	10 622 823	10 020 339	9 956 777	10 343 007
Trinidad & Tobago	2 275 000	2 336 500	2 055 300	2 071 500	2 062 800
USA	40 854 000	42 300 000	37 200 000	37 900 000	36 100 000
Argentina	4 138 600	4 147 500	4 466 500	4 437 400	4 389 100
Brazil	32 449 000	34 558 000	33 884 000	32 452 000	35 571 000
Chile	987 800	1 137 000	1 100 000	1 115 000	1 135 000
Colombia	283 300	288 000	325 000	352 000	343 000
Paraguay	98 000	119 000	123 000	128 000	110 000
Peru	310 400	353 000	386 000	417 000	423 000
Venezuela	6 645 700	7 825 000	8 900 000	8 420 000	7 900 000
Burma	*40 000	*40 000	*40 000	*40 000	*40 000
China	213 666 800	268 309 900	343 751 900	412 451 900	469 446 300
India	33 601 000	34 238 000	39 177 000	43 288 000	46 884 000
Indonesia	1 171 000	1 436 000	1 268 000	1 200 000	1 400 000
Iran (a)	8 328 619	8 545 732	*9 200 000	*9 000 000	*9 600 000
Japan	82 090 744	82 974 493	83 058 130	84 270 419	86 770 755
Kazakhstan	4 136 820	4 283 142	3 582 198	3 369 395	3 795 352
Korea, Dem. P.R. of	*250 000	*250 000	*250 000	*250 000	*250 000
Korea, Republic of	27 314 000	27 555 998	27 919 911	27 559 407	29 436 783
Malaysia	1 600 000	1 710 000	1 350 000	1 277 000	1 800 000
Pakistan	*1 000 000	*1 000 000	*1 000 000	*850 000	*900 000
Qatar	776 000	830 000	815 382	876 885	*865 000
Saudi Arabia	3 285 000	3 406 000	3 626 000	3 581 000	3 600 000
Taiwan	10 260 000	10 354 000	9 447 000	10 407 000	10 550 000
Vietnam	200 000	187 000	202 000	211 000	220 000

Production of pig iron

tonnes

Country	2003	2004	2005	2006	2007
Australia	8 557 000	6 428 000	6 212 000	6 276 000	6 369 000
New Zealand	700 000	719 000	652 000	664 000	679 000
World Total	718 900 000	788 300 000	856 200 000	934 800 000	1 004 900 000

Note(s):-
(1) The data in this table include sponge iron and direct reduced iron (DRI) , where these have been separately identified

(a) Years ended 20 March following that stated

Production of crude steel

tonnes

Country	2003	2004	2005	2006	2007
Albania	86 117	115 000	140 000	—	100 000
Austria	6 261 000	6 529 000	7 031 000	7 129 000	7 577 000
Azerbaijan	32 700	90 400	286 100	335 300	273 400
Belarus	1 572 868	1 920 019	2 075 523	2 135 651	2 214 019
Belgium	11 114 775	11 697 000	10 422 000	11 631 000	10 692 000
Bosnia & Herzegovina	95 000	75 000	289 000	469 122	513 867
Bulgaria	1 950 000	2 106 000	1 969 000	2 124 000	2 050 000
Croatia	43 380	85 947	73 640	80 516	76 252
Czech Republic	6 783 000	7 033 000	6 189 000	6 862 000	7 059 000
Finland	4 766 203	4 832 427	4 738 446	5 053 714	4 430 726
France	19 757 864	20 770 252	19 480 777	19 852 125	19 249 862
Germany	44 809 000	46 377 000	44 524 000	47 224 000	48 550 000
Greece	1 701 000	1 967 000	2 266 000	2 416 000	2 554 000
Hungary	2 044 526	1 944 017	2 004 250	2 089 000	2 227 000
Italy	27 058 000	28 603 000	29 349 000	31 625 000	31 506 000
Latvia	546 000	550 000	550 000	550 000	550 000
Luxembourg	2 675 000	2 684 000	2 194 000	2 802 000	2 858 000
Macedonia	306 635	319 873	321 170	326 484	370 317
Moldova	850 000	1 011 000	1 016 000	784 000	965 000
Montenegro	—	—	—	193 165	173 849
Netherlands	6 561 000	6 848 000	6 919 000	6 372 000	7 368 000
Norway	703 000	725 000	705 000	684 000	708 000
Poland	9 107 384	10 578 482	8 335 898	9 991 638	9 831 723
Portugal	1 000 000	1 400 000	1 400 000	1 400 000	1 400 000
Romania	5 692 496	6 076 600	6 280 000	6 266 036	6 261 376
Russia	62 839 334	65 582 851	66 146 000	69 307 877	72 220 000
Serbia	—	—	—	1 644 000	1 478 000
Serbia and Montenegro	722 376	1 175 000	1 292 000	—	—
Slovakia	4 588 000	4 454 000	4 485 000	5 093 000	5 082 000
Slovenia	541 000	566 000	583 000	628 000	638 000
Spain	16 407 000	17 700 000	17 825 000	18 391 000	18 998 000
Sweden	5 708 500	5 978 000	5 725 600	5 466 100	5 672 900
Switzerland	*1 000 000	*1 000 000	1 158 000	1 252 000	1 264 000
Turkey	17 644 020	19 868 118	20 961 240	23 307 523	25 760 889
Ukraine	36 922 000	38 738 000	38 641 000	27 337 000	42 830 000
United Kingdom	13 128 500	13 765 700	13 238 900	13 904 600	14 312 200
Algeria	1 051 000	1 014 000	1 007 000	1 158 000	1 278 000
Egypt	4 398 000	4 810 000	5 603 000	6 045 000	6 224 000
Libya	1 007 000	1 026 000	1 255 000	1 151 000	1 250 000
Morocco	...	...	205 000	314 000	512 000
Nigeria	...	40 000	100 000	100 000	100 000
South Africa	9 481 000	9 500 000	9 494 000	9 721 000	9 100 000
Tunisia	85 600	69 900	65 700	67 700	60 900
Zimbabwe	152 000	135 000	107 000	24 000	23 000
Canada	15 831 473	16 428 000	15 327 000	15 493 000	15 718 000
Cuba	210 000	193 151	245 076	257 200	262 400
Dominican Republic	*61 000	*61 000	*61 000	*61 000	*61 000
El Salvador	56 900	60 000	48 000	74 000	73 000

Production of crude steel

tonnes

Country	2003	2004	2005	2006	2007
Guatemala	226 000	232 000	207 000	292 000	349 000
Mexico	15 158 768	16 737 037	16 282 299	16 446 939	17 562 694
Trinidad & Tobago	896 000	789 800	712 000	673 000	694 600
USA	93 677 000	99 681 000	94 897 000	98 557 000	98 181 000
Argentina	5 033 200	5 125 200	5 382 000	5 532 700	5 387 600
Brazil	31 147 000	32 909 000	31 610 000	30 901 000	33 782 000
Chile	1 377 400	1 579 000	1 541 000	1 607 000	1 689 000
Colombia	668 400	806 000	1 007 000	1 211 000	1 253 000
Ecuador	79 800	72 000	83 000	86 000	89 000
Paraguay	91 000	115 000	101 000	103 000	98 000
Peru	668 400	726 000	790 000	901 000	753 000
Uruguay	40 500	58 000	64 000	57 000	60 000
Venezuela	3 930 300	4 561 000	4 907 000	4 693 000	5 081 000
China	222 336 000	282 911 000	353 239 800	419 148 500	489 660 000
Hong Kong	*100 000	*100 000	*100 000	*100 000	...
India	31 779 000	32 626 000	45 780 000	49 450 000	53 080 000
Indonesia	2 042 233	3 681 865	3 675 442	3 756 347	4 016 034
Iran (a)	7 990 971	8 989 640	9 404 000	9 789 000	10 051 000
Israel	*150 000	*280 000	*300 000	*300 000	*300 000
Japan	110 510 520	112 717 664	112 471 374	116 226 201	120 202 937
Jordan	*135 000	*140 000	150 000	150 000	150 000
Kazakhstan	5 069 400	5 371 698	4 476 642	4 244 521	4 784 105
Korea, Dem. P.R. of	*300 000	*300 000	*300 000	*300 000	*300 000
Korea, Republic of	46 309 629	47 520 871	47 820 037	48 455 454	51 517 309
Kuwait	*100 000	*200 000	*450 000	*500 000	...
Malaysia	3 960 000	5 698 000	5 296 000	5 834 000	6 120 000
Pakistan	1 000 000	1 145 000	825 000	1 040 000	1 090 000
Philippines	500 000	400 000	470 000	558 000	718 000
Qatar	1 055 000	1 089 000	1 057 000	1 039 220	1 174 917
Saudi Arabia	3 944 000	3 902 000	4 186 000	3 976 000	4 644 000
Singapore	561 000	610 000	572 000	607 000	640 000
Syria	*70 000	*70 000	*70 000	*70 000	*70 000
Taiwan	18 828 323	19 592 755	18 563 247	19 974 997	20 700 389
Thailand	3 551 000	4 533 000	5 161 000	4 914 000	5 565 000
United Arab Emirates	*90 000	*90 000	*90 000	*90 000	*90 000
Uzbekistan	499 000	602 000	595 000	730 000	649 000
Vietnam	543 006	658 467	656 734	1 400 000	2 000 000
Australia	9 661 000	8 104 000	7 789 000	7 937 000	7 900 699
New Zealand	853 000	885 000	889 000	810 000	845 000
World Total	973 000 000	1 072 000 000	1 144 000 000	1 232 000 000	1 344 000 000

Note(s):-
(1) Unless otherwise indicated, these figures include production from scrap
(2) Small amounts of steel are believed to be produced in Burma, DR Congo, Estonia, Ghana, Kenya, Mauritania, Sri Lanka and Uganda

(a) Years ended 20 March following that stated

Production of ferro-alloys

tonnes

Country	2003	2004	2005	2006	2007
Albania					
Ferro-chrome	37 800	47 700	35 780	17 040	—
Austria					
Ferro-molybdenum	4 400	4 700	5 000	5 000	5 000
Ferro-nickel	2 000	1 900	2 500	2 500	3 000
Ferro-vanadium	5 300	5 800	6 250	6 250	6 500
Bulgaria					
Ferro-silicon	*8 000	*8 000	*8 000	*8 000	*8 000
Czech Republic					
Ferro-vanadium	*3 000	*3 400	*2 700	*2 800	*1 700
Finland					
Ferro-chrome	250 000	264 492	234 881	243 350	241 760
France					
Ferro-manganese & spiegeleisen	356 192	110 072	109 111	139 533	98 066
Ferro-silico-manganese	60 700	64 100	52 300	63 300	*50 000
Ferro-silicon	*100 000	*100 000	*100 000	*100 000	*100 000
Silicon metal	*85 000	*85 000	*85 000	*85 000	*85 000
Georgia					
Ferro-manganese	12 425	12 821	13 945	5 130	*7 000
Ferro-silico-manganese	50 932	93 830	109 414	116 945	*125 000
Germany					
Ferro-chrome	18 318	24 857	22 672	26 710	22 030
Other ferro-alloys	*30 000	*30 000	*30 000	*30 000	*30 000
Silicon metal	27 870	28 773	29 349	29 865	29 379
Greece					
Ferro-nickel	90 000	91 000	*96 000	*89 000	*94 000
Iceland					
Ferro-silicon	117 171	119 389	114 844	113 798	114 886
Italy					
Ferro-manganese	25 000	38 000	32 000	*30 000	*30 000
Ferro-silico-manganese	*100 000	108 000	99 000	96 600	87 000
Macedonia					
Ferro-nickel	5 629	5 313	8 141	10 942	15 321
Ferro-silicon	49 905	66 769	71 249	59 023	78 892
Norway					
Ferro-manganese	*130 000	*130 000	*130 000	*130 000	*130 000
Ferro-silico-manganese	*250 000	*260 000	*290 000	*310 000	*280 000
Ferro-silicon	*350 000	389 599	*165 000	*80 000	...
Other ferro-alloys	*50 000	*60 000	*60 000	*60 000	*62 000
Silicon metal	*150 000	193 566	178 572	*150 000	*140 000
Poland					
Ferro-manganese	979	46 898	7 782	4 089	2 093
Ferro-silico-manganese	5 000	29 600	10 242	3 310	15 590
Ferro-silicon	92 687	83 552	65 118	13 034	58 538
Other ferro-alloys	188	1 419	3 663	4 488	6 255
Romania					
Ferro-manganese	—	191	18 625	3 777	—
Ferro-silico-manganese	141 899	194 754	100 957	66 476	33 585
Russia					
Spiegeleisen	*7 000	*7 000	*7 000	*7 000	*7 000
Ferro-chrome	351 729	453 639	511 600	500 837	564 474
Ferro-silico-chrome	63 558	83 372	74 150	92 404	97 915
Ferro-manganese	*101 000	*108 000	*108 000	*125 000	*125 000
Ferro-silico-manganese	*83 000	*143 000	*145 000	*170 000	*170 000
Ferro-nickel	17 000	20 370	17 000	20 795	*21 000
Ferro-silicon	702 000	720 000	*742 000	*750 000	*750 000
Other ferro-alloys	*30 000	*36 000	*34 900	*35 000	*35 000
Silicon metal	*45 000	*45 000	*45 000	*45 000	*45 000
Slovakia					
Ferro-chrome	1 924	1 784	867	19	—
Ferro-silico-manganese	52 733	64 862	47 843	59 128	...
Ferro-silicon	41 539	34 684	16 512	16 155	...
Other ferro-alloys	44 589	68 096	48 161	65 498	...
Slovenia					
Ferro-silicon	*12 000	*18 000	*11 000	*9 000	*1 000

Production of ferro-alloys

tonnes

Country	2003	2004	2005	2006	2007
Spain					
Ferro-manganese	*35 000	*35 000	*35 000	*35 000	*35 000
Ferro-silico-manganese	*100 000	*100 000	*100 000	*100 000	*100 000
Ferro-silicon	*60 000	*60 000	*60 000	*60 000	*60 000
Silicon metal	*25 000	*25 000	*25 000	*25 000	*25 000
Sweden					
Ferro-chrome	106 100	127 300	127 500	136 400	124 400
Ferro-silicon	17 100	18 500	9 800	4 600	4 300
Turkey					
Ferro-chrome	35 393	33 686	26 043	67 975	69 730
Ferro-silico-chrome	6 715	5 560	6 695	7 310	6 624
Ukraine					
Spiegeleisen	*5 000	*5 000	*5 000	*5 000	*5 000
Ferro-manganese	383 200	498 800	359 000	373 000	368 000
Ferro-silico-manganese	991 600	1 088 600	1 045 900	1 168 000	1 281 000
Ferro-nickel	52 000	78 000	*78 000	*78 000	*78 000
Ferro-silicon	286 200	324 700	227 500	169 000	218 000
Other ferro-alloys	...	...	87 985	133 402	141 912
Egypt					
Ferro-silicon (c)	*55 000	*55 000	55 000	*50 000	*50 000
Other ferro-alloys (c)	*30 000	*30 000	*30 000	*30 000	*30 000
South Africa					
Ferro-chrome	2 813 000	3 031 515	2 811 836	2 893 400	3 626 871
Ferro-manganese	607 362	611 914	570 574	*570 000	*570 000
Ferro-silico-manganese	313 152	373 928	275 324	*275 000	*275 000
Ferro-silicon	135 300	140 600	127 000	*127 000	*127 000
Ferro-vanadium	*18 000	*25 000	*25 000	*25 000	*25 000
Silicon metal	48 500	50 500	53 500	*54 000	*54 000
Swaziland					
Ferro-vanadium	1 011	1 150	345	—	—
Zimbabwe					
Ferro-chrome	261 095	218 065	218 143	200 673	200 833
Ferro-silico-chrome	—	987	4 882	1 024	3 097
Canada					
Ferro-niobium	5 000	*5 300	*4 800	*6 400	*6 800
Ferro-silicon	*70 000	*70 000	*70 000	*70 000	*70 000
Silicon metal	*30 000	*30 000	*30 000	*30 000	*30 000
Dominican Republic					
Ferro-nickel	69 545	75 764	73 962	76 659	75 069
Mexico					
Ferro-manganese	55 903	72 471	89 642	62 485	69 903
Ferro-silico-manganese	81 223	103 206	104 780	97 457	109 286
USA					
Ferro-silicon	147 964	170 592	209 000	253 000	271 000
Silicon metal	133 680	144 489	148 000	*148 000	*150 000
Argentina					
Ferro-silico-manganese	*5 000	*5 000	*5 000	*5 000	*5 000
Ferro-silicon	2 700	2 700	*2 700	*2 700	*2 700
Other ferro-alloys	*15 000	15 000	*15 000	*15 000	*15 000
Silicon metal	*8 000	*8 000	*8 000	*8 000	*8 000
Brazil					
Ferro-chrome	196 032	204 626	185 533	158 585	177 656
Ferro-silico-chrome	8 151	11 560	16 683	8 221	12 943
Ferro-silico-magnesium	14 040	37 031	43 980	31 314	30 221
Ferro-manganese	176 735	179 971	257 083	61 434	135 757
Ferro-silico-manganese	261 658	285 629	341 565	198 753	225 373
Ferro-nickel	19 378	20 338	21 200	27 600	28 900
Ferro-niobium	37 303	35 863	58 616	60 826	71 676
Ferro-silicon	156 824	177 245	199 856	196 814	196 403
Other ferro-alloys	38 559	45 868	42 588	44 280	45 330
Silicon metal	180 937	219 813	229 294	226 380	225 120
Chile					
Ferro-molybdenum	4 423	5 762	...	...	...
Colombia					
Ferro-nickel	108 100	111 700	122 700	118 900	114 600

Production of ferro-alloys

tonnes

Country	2003	2004	2005	2006	2007
Venezuela					
Ferro-manganese	*12 000	*15 000	*15 000	*15 000	*15 000
Ferro-silico-manganese	30 632	*35 000	*35 000	*35 000	*35 000
Ferro-nickel	75 278	67 796	*56 000	*56 000	*56 000
Ferro-silicon	90 534	*92 000	*92 000	*92 000	*92 000
Bhutan					
Ferro-silicon	*21 000	21 147	*20 000	*20 000	...
China					
Ferro-chrome	534 842	635 000	854 000	1 042 500	1 296 000
Ferro-silico-chrome	97 552	105 000	48 000	35 000	38 700
Other ferro-alloys	5 738 000	8 180 000	9 698 000	*12 000 000	*15 000 000
Silicon metal	*600 000	*660 000	*650 000	*730 000	*814 000
India					
Ferro-aluminium (b)	5 169	5 917	7 214	9 947	9 377
Ferro-chrome (b)	525 824	594 994	662 297	801 368	948 601
Ferro-silico-magnesium (b)	6 289	7 092	11 171	11 387	13 525
Ferro-manganese (b)	248 388	270 234	273 057	296 726	391 210
Ferro-silico-manganese (b)	380 316	498 047	596 372	782 962	911 402
Ferro-molybdenum (b)	2 949	2 864	2 827	3 120	2 899
Ferro-silicon (b)	68 844	99 296	90 652	92 632	83 716
Ferro-titanium (b)	252	512	735	1 761	1 937
Ferro-vanadium (b)	769	826	877	1 139	1 585
Other ferro-alloys (b)	166	211	225	409	362
Indonesia					
Ferro-manganese	*12 000	*12 000	*12 000	*12 000	*12 000
Ferro-silico-manganese	*7 000	*7 000	*4 000	*5 000	*5 000
Ferro-nickel	43 894	39 538	20 036	14 774	18 532
Iran					
Ferro-chrome (a)	8 000	7 750	*8 000	*8 000	*8 000
Ferro-silicon (a)	40 297	50 140	*50 000	*50 000	*50 000
Japan					
Ferro-chrome	19 427	13 472	12 367	13 056	12 016
Ferro-manganese	371 831	437 389	448 616	406 162	420 151
Ferro-silico-manganese	61 618	73 041	94 725	59 424	52 901
Ferro-molybdenum	2 691	3 323	4 019	4 229	4 573
Ferro-nickel	369 099	374 213	391 074	335 884	351 503
Ferro-tungsten	12	—	—	—	—
Ferro-vanadium	3 491	2 178	2 360	2 042	3 205
Other ferro-alloys	3 813	7 321	10 057	13 123	13 982
Kazakhstan					
Ferro-chrome	993 007	1 080 993	1 156 167	1 190 673	1 307 536
Ferro-silico-chrome	98 134	104 800	97 870	117 607	145 685
Ferro-silico-manganese	178 924	155 324	170 001	218 323	188 445
Ferro-silicon	127 161	103 580	104 186	85 924	59 886
Other ferro-alloys	...	...	...	1 787	1 222
Korea, Dem. P.R. of					
Ferro-alloys	*10 000	*10 000	*10 000	*10 000	*10 000
Korea, Republic of					
Ferro-manganese	141 000	165 525	124 000	169 202	209 321
Ferro-silico-manganese	90 942	82 917	74 000	94 119	105 607
Australia					
Ferro-manganese (c)	104 022	133 985	166 513	114 715	133 816
Ferro-silico-manganese (c)	130 568	116 630	96 575	103 207	105 800
Silicon metal	*30 000	*30 000	*30 000	*30 000	*30 000
New Caledonia					
Ferro-nickel	167 208	151 296	172 067	180 724	*170 000

Note(s):-
(a) Years ended 20 March following that stated
(b) Years ended 31 March following that stated
(c) Years ended 30 June of that stated

Production of kaolin

tonnes

Country	2003	2004	2005	2006	2007
Albania	—	300 000	310 000	*300 000	*300 000
Austria	15 034	16 345	16 410	17 431	16 929
Belgium	*300 000	*300 000	*300 000	*300 000	*300 000
Bosnia & Herzegovina	13 178	13 500	14 500	*24 500	20 767
Bulgaria	*120 000	*190 000	*200 000	*240 000	*240 000
Czech Republic (h)	591 000	596 000	649 000	673 000	682 000
France	335 000	316 000	319 464	*300 000	307 253
Germany (g)	738 123	*740 000	*750 000	*750 000	*750 000
Greece	59 680	53 438	49 912	*50 000	*50 000
Hungary	...	3 300	1 300	1 350	2 136
Italy	224 755	246 608	183 804	*180 000	*180 000
Poland (k)	106 761	130 596	159 207	148 579	153 670
Portugal	169 669	152 077	164 072	167 792	*170 000
Romania	25 741	22 338	26 772	11 063	6 879
Russia	*45 000	*45 000	*45 000	*45 000	*45 000
Serbia	—	—	—	214 735	97 432
Serbia and Montenegro	99 460	108 000	135 000	—	—
Slovakia	31 000	46 000	31 000	58 000	46 000
Spain (k)	427 193	437 990	463 398	476 327	475 000
Turkey	370 455	536 008	615 271	*600 000	*600 000
Ukraine (h)	169 900	202 300	216 600	251 000	244 000
United Kingdom (a) (l)	2 097 137	1 944 955	1 910 874	1 762 328	1 671 426
Algeria	19 258	27 700	34 386	32 523	106 567
Egypt	*260 000	249 761	415 400	*400 000	300 000
Eritrea	140	50	518	118	17
Ethiopia (b)	3 088	4 251	3 726	1 641	4 000
Kenya	*740	*760	*780	*780	*1 000
Nigeria	57 587	92 875	*92 000	96 590	60 000
South Africa	86 365	81 901	59 356	51 602	51 218
Sudan	...	...	...	11 641	27 846
Cuba	2 900	4 128	3 457	1 700	1 700
Mexico	798 407	654 711	877 147	961 800	970 598
USA (e)	7 680 000	7 760 000	7 800 000	7 470 000	*7 330 000
Argentina	19 219	39 072	54 903	49 619	*50 000
Brazil (h)	2 081 000	2 381 000	2 410 000	2 455 000	2 527 000
Chile	11 500	51 769	15 183	44 642	87 901
Ecuador	11 884	5 646	25 078	11 504	18 618
Paraguay	*66 600	*66 600	*66 600	*66 000	*66 000
Peru	2 653	2 720	1 200	1 022	7 532
Venezuela	*10 000	*10 000	*10 000	*10 000	*10 000
Bangladesh (d)	9 630	13 113	13 738	19 766	*20 000
China	2 700 000	3 120 000	3 120 000	3 270 000	*3 300 000
India (c) (i)	209 920	220 262	238 759	251 492	*261 000
Indonesia	*15 000	*15 000	*15 000	*15 000	*15 000
Iran (j)	556 003	596 886	531 109	803 270	...
Japan	12 223	11 553	*12 000	*12 000	*12 000
Jordan	179 153	216 566	168 264	112 787	...
Kazakhstan	*20 000	*10 000	*10 000	5 000	5 000
Korea, Republic of	1 042 018	936 537	1 074 936	958 836	1 053 576
Malaysia	425 942	326 928	494 511	341 223	587 508
Pakistan (d)	39 575	25 204	37 732	53 051	30 979
Philippines	1 860	3 240	6 927	2 232	2 200
Saudi Arabia	8 100	2 135	1 489	3 957	...
Sri Lanka	9 073	16 233	9 914	10 914	11 178
Taiwan	22 448	35 001	9 423	4 107	5 060
Thailand (h)	185 512	200 671	156 853	157 900	159 186
Uzbekistan (i)	*150 000	*150 000	*150 000	*150 000	*150 000
Vietnam	644 200	741 200	780 000	*800 000	*800 000

Production of kaolin

tonnes

Country	2003	2004	2005	2006	2007
Australia (d) (f)	280 000	285 543	231 611	182 304	213 905
New Zealand	14 770	15 250	15 750	14 864	14 130
World Total	23 600 000	24 800 000	25 500 000	25 400 000	25 500 000

Note(s):-
(1) In addition to the countries listed Denmark is believed to produce kaolin

(a) Sales
(b) Years ended 7 July of that stated
(c) Years ended 31 March following that stated
(d) Years ended 30 June of that stated
(e) Sold or used by producers
(f) Excluding New South Wales
(g) Washed and dried
(h) Beneficiated
(i) Beneficiated; excludes directly used natural kaolin
(j) Years ended 20 March following that stated
(k) Washed
(l) Dry weight

LEAD

Characteristics

Lead is a dense (11.34 g/cm^3), bluish-white metal with little mechanical strength and virtually no elasticity. It is extremely soft and highly malleable, with a low melting point (327.4ºC). When freshly cut the surface has a metallic lustre, but this quickly tarnishes to dull grey when exposed to air due to oxidation. It has poor electrical conductivity compared to other metals. Lead is a potent neurotoxin that accumulates in soft tissues and bone over time, and this has lead to increasing restriction in its usage in recent years.

Lead is rarely found as native (free) metal, but is usually extracted from sulphide ores in which the most common lead mineral is galena (lead sulphide; PbS). It is usually found in association with other sulphide minerals also used as ores, most frequently those of zinc and copper, but also precious metals. Silver commonly occurs in galena both in solid solution and as a sulphide phase. Galena is the chief source of commercial silver output. Other economic lead ore minerals include cerussite (lead carbonate; $PbCO_3$) and anglesite (lead sulphate; $PbSO_4$), commonly found as weathering products overlying sulphide ore bodies. In terms of mine output lead is almost always a co-product with other base metals.

Lead is obtained from galena by smelting. This involves roasting the ore to remove the sulphur and to obtain lead oxide, which is then reacted with coke in a furnace. The resulting lead bullion contains many impurities such as silver and gold (hence the name bullion) as well as antimony, arsenic, copper, tin and zinc. These impurities are then removed by various refining steps to obtain pure lead International Lead Association, 2008).

World reserves of lead are 79 million tonnes, of which Australia holds 24 million tonnes, China 11 million tonnes and USA 7.7 million tonnes (USGS, 2008).

Uses

Current global use of lead (ILZSG, 2008):

- lead-acid batteries 80 per cent
- pigments 5 per cent
- rolled extrusions 6 per cent
- shot/ammunition 3 per cent
- alloys (including casting) 2 per cent
- cable sheathing 1 per cent
- miscellaneous 3 per cent

The most important use of lead is in lead-acid batteries which provide ancillary electrical power (chiefly for starting) in virtually all road vehicles and also in electrically driven vehicles. They also provide emergency power in the event of power failure. Lead's softness and low melting point make lead very easy to work hence it has a long history of exploitation. Its high resistance to corrosion makes it ideal for weather-proofing buildings and for equipment used in the manufacture of acids. Lead's high density means that it absorbs radiation and noise. It is thus used as radiation shielding in medical applications and the nuclear industry, and in sound-proofing. Lead chromate (yellow) and lead molybdate (red/orange) are used as colouring pigments for ceramic glazes, plastics and to a lesser extent under current legislation, paints e.g. in road paint. Lead oxide (PbO) in glass reduces the transmission of radiation, and glasses for VDU equipment may contain up to 28 per cent PbO (International Lead Association, 2008). Other minor uses include weights and molten lead is used as a coolant in fast reactors.

Owing to its toxicity, lead use has become more strictly regulated and restricted over the last 30 years. Initially, the change was due to the requirement of US lead consumers to comply with environmental regulations which significantly reduced or eliminated the use of lead in non-battery products, including as a petrol additive, in paints, solders, and water systems. Lead use is being further curtailed by the European Union's RoHS Directive which came into force on 1 July 2006. Lead may still be found in harmful quantities in stoneware, vinyl (such as that used for tubing and the insulation of electrical cords), and in brass manufactured in China. Throughout 2006–2007, many children's toys made in China were recalled due to lead in paint used to colour the product; e.g. the toy firm Mattel recalled 55 000 Chinese-made toys in the US after lead contamination fears (BBC News, 25 October 2007).

World production in 2007

World mined production of lead was 1.3 million tonnes in 2007 (metal content). This represents a 1.6 per cent increase since 2006 and a 14 per cent increase since 2003. Primary (mined) lead production is dominated by China, which mines more than twice as much as the next largest lead-mining country, Australia.

Worldwide production of refined lead was 8.1 million tonnes in 2007; a 1.4 per cent increase over 2006 production. Production has increased 18 per cent since 2003, although levelling out since 2005, reflecting the flattening off of production particularly from China. China is the top producing country with 2.8 million tonnes in 2007. This represents a 1.6 per cent increase on 2006 and a 76 per cent increase since 2003. The USA was the second largest producer with 1.3 million tonnes (less than half of Chinese production) and Germany, third, with production of 0.3 million tonnes.

It is estimated that worldwide more than 50 per cent of refined lead produced is from recycled material. Producing lead in this way requires around one third of the energy needed to extract it from its ores. (International Lead Association, 2008).

Prices

Prices have more than halved over the course 2008. Dropping from around US$2500 per tonne in January 2008 to around the US$1000 per tonne by the end of the year, almost four times less than the highest price in 2007. The prices peaked in early March 2008 at around US$3400 per tonne, before dropping fairly steadily until the end of the year with a minor price peak in mid July. (Metal Bulletin, 2008a).

Severe storms in China in early 2008 and the earthquake in Sichuan province in May both resulted in mine and smelter to closures. These events caused lead premiums to increase and also contributed towards the drop in Chinese exports during 2008 (Mining Journal, 2008a) Exports had already fallen significantly since the introduction of the 10 per cent export tax in 2007.

After the March price peak, the ensuing price drop was attributed to increasing lead surplus and dropping demand. In the USA, rising recycling rates contributed to the drop in demand for lead from primary sources. By August, attempts to protect the European premiums included shipping excess lead away to non LME warehouses, including those in Dubai (Metal Bulletin, 2008b)

Average lead cash LME daily official prices. Source: Metal Bulletin 2008 (www.metalbulletin.com)

Industry events in 2008

In February, two Indian companies announced plans to build new lead smelters. Hindustan Zinc Ltd, the world's largest integrated lead–zinc producer, plans to more than double its capacity by building a 100 000 tonnes per year smelter and Pondy Oxides & Chemicals plans to build a 50 000 tonnes per year smelter. This new smelter, will have 10 times the capacity of their existing smelter which uses lead scrap as its feedstock. Hindustan Zinc Ltd, is the only domestic producer of lead concentrates and currently India imports more than half the lead it consumes which are subject to a 5 per cent import tax. (Metal Bulletin, 2008c)

In China's central Hunan province, snow storms early in the year resulted in power outages, which caused smelters to shut temporarily. Then, in May the earthquake in Sichuan province and subsequent aftershocks halted production at smelters and suspended mining in both Sichuan province and in the neighbouring Gansu province for almost a month.

Lead poisoning from Xstrata's Mt Isa smelter was reported in May. A study by Queensland Health showed that 45 in 400 children from the area had blood levels above the World Health Organisation's safe level. (Mining Environmental Management, 2008). Meanwhile in Canada, Teck's Trail lead refinery in British Columbia was shut down at the end of May after an accidental leakage of 950 kilograms of lead into the Columbia river. In early October, lead and other base metal smelters closed in a city in Guangxi province, China, after 200 people fell ill when a typhoon washed smelter waste into the water systems. (Metal Bulletin, 2008d)

Important industry mergers included Zinifex and Oxiana ltd, who merged on 1st July, to form Oz Minerals. However the new company struggled through the second half of the year. By year end they were under review and had entered voluntary suspension after being unable to refinance their debt, citing exchange rates, low commodity prices and the tight credit market. (Mining News, 2008a). In June, Silvercorp Metals Inc took over Yangtze Mining, with lead, zinc and silver deposits in Guangdong province, China.

In the second half of the year, low lead prices forced mine and project closures, output reductions and staff cuts. Notably these include Teck's (formerly Teck Cominco) closure of its Lennard Shelf Mine two years earlier than originally planned. (Mining Journal, 2008b). Doe Run Company, the largest lead producer in the USA, shut one of its two lead furnaces in Montana in October and announced it was unlikely to reopen it unless the price improved. (Metal Bulletin, 2008e)

In December, Magellan Metals (a subsidiary of Ivernia Inc) received approval to export 8000 tonnes of lead concentrate which it had stockpiled at the port of Esperance, since April 2007. Output was suspended after 4000 seabirds died of lead poisoning and elevated lead levels were found in the town's children. Magellan agreed to contribute US$9 million towards cleaning up the port and town. Ivernia's Magellan Mine near Wiluna (the world's only pure primary lead mine) has been on care and maintenance since that time. They have proposed to ship future exports through Freemantle. (Mining News, 2008b)

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Mine production of lead

tonnes (metal content)

Country	2003	2004	2005	2006	2007
Bosnia & Herzegovina	200	900	1 100	1 152	4 188
Bulgaria	19 950	*19 400	*18 500	*16 000	*17 600
Greece	2 000	—	3 000	10 400	15 700
Ireland, Republic of	50 300	63 800	72 200	61 800	52 700
Italy	2 700	800	*800	*800	*800
Macedonia	—	—	—	9 349	29 221
Poland	87 100	86 000	78 980	77 450	74 200
Portugal	—	—	—	—	1 000
Romania	15 747	18 297	11 610	6 269	784
Russia	24 000	23 200	36 400	34 000	48 000
Serbia	—	—	—	7 000	7 000
Serbia and Montenegro	4 567	*5 300	2 000	—	—
Spain	1 765	—	—	—	—
Sweden	50 962	54 347	60 445	55 644	63 224
Turkey	17 483	18 792	11 341	14 000	14 000
United Kingdom	*700	*500	*400	*400	*100
Morocco	39 387	41 400	46 000	41 300	42 200
Namibia	16 112	14 338	14 320	11 830	11 000
South Africa	39 941	37 485	42 159	48 273	41 857
Tunisia	5 100	5 332	8 407	—	—
Canada	81 264	76 730	79 254	83 096	75 135
Honduras	9 014	8 877	10 488	11 775	10 215
Mexico	139 348	118 484	134 388	135 025	137 133
USA	460 200	445 000	436 500	429 300	433 800
Argentina	12 079	9 551	10 683	12 778	*11 000
Bolivia	9 353	10 252	11 231	11 955	22 798
Brazil	10 652	14 737	16 063	16 007	15 522
Chile	1 697	2 286	878	672	1 305
Peru	308 874	306 211	319 345	313 332	329 154
Burma	*2 000	*2 000	*2 000	*2 000	*2 000
China	954 600	997 200	1 142 000	1 330 000	1 360 000
India (a)	46 700	52 200	61 655	69 165	80 900
Iran (b)	20 000	21 000	21 179	30 000	25 000
Japan	5 700	5 500	3 400	800	—
Kazakhstan	38 200	44 135	45 370	48 100	40 200
Korea, Dem. P.R. of	*20 000	*20 000	*20 000	*25 000	*30 000
Korea, Republic of	—	40	50	17	12
Tajikistan	—	—	407	—	—
Vietnam	*1 100	*2 800	*3 300	*3 500	*3 500
Australia	688 000	674 000	767 000	668 000	641 000
World Total	3 200 000	3 200 000	3 500 000	3 600 000	3 600 000

Note(s):-
(a) Years ended 31 March following that stated
(b) Years ended 20 March following that stated

Production of refined lead

tonnes

Country	2003	2004	2005	2006	2007
Austria	*20 000	*26 000	*24 000	*22 000	*22 000
Belgium	65 000	86 000	103 000	101 000	110 000
Bulgaria	69 000	66 000	81 000	76 000	87 000
Czech Republic	*26 000	*25 000	26 000	26 100	26 000
Estonia	—	3 000	*7 000	*7 000	*10 000
France	91 000	89 000	*90 000	*88 000	*88 000
Germany	356 900	359 200	341 700	321 500	355 081
Greece	*4 000	*3 000	*6 000	*6 000	*11 000
Ireland, Republic of	7 800	19 600	22 500	21 700	22 500
Italy	214 100	201 600	211 000	190 500	211 800
Macedonia	6 357	3 591	—	—	—
Netherlands	*17 000	*17 000	*17 000	*16 000	*16 000
Poland	74 300	73 900	81 000	73 000	104 200
Portugal	4 000	4 000	3 000	3 000	5 000
Romania	28 000	37 600	37 900	29 133	34 369
Russia	66 000	66 000	65 700	80 000	83 000
Serbia and Montenegro	493	800	—	—	—
Slovenia	*15 000	*15 000	*15 000	*15 000	*15 000
Spain	99 100	105 600	110 000	129 000	136 000
Sweden	73 340	73 548	72 760	70 239	69 730
Switzerland	9 600	9 300	9 600	*9 600	*9 000
Turkey	*9 000	*9 000	*9 000	*9 000	*9 000
Ukraine	13 000	*15 000	61 400	56 300	62 100
United Kingdom	364 574	245 938	304 350	318 703	263 391
Algeria	*6 000	*6 000	*6 000	*6 000	*6 000
Kenya	*1 000	*1 000	*1 000	*1 000	*1 000
Morocco	61 473	25 000	54 000	45 000	43 000
Nigeria	*5 000	*5 000	*5 000	*5 000	*5 000
South Africa	65 000	64 000	65 300	67 000	59 000
Canada	223 434	241 169	230 237	250 464	236 688
El Salvador	8 000	10 000	10 000	10 000	10 000
Mexico	247 500	217 400	213 700	227 300	193 293
USA (b)	1 392 000	1 262 000	1 293 000	1 297 000	1 303 000
Argentina	41 311	49 111	45 607	47 100	*47 000
Brazil (a)	128 610	137 121	104 904	142 653	142 540
Colombia	*9 000	*9 000	*10 000	*10 000	*10 000
Peru	112 289	118 970	122 079	120 311	116 774
Venezuela	*32 000	*35 000	*35 000	*36 000	*36 000
Burma	900	300	500	500	*500
China	1 564 100	1 934 500	2 391 400	2 714 900	2 757 400
India	71 000	49 000	59 000	104 000	124 000
Indonesia	18 000	20 000	18 000	18 000	18 500
Iran	54 000	54 000	71 000	74 000	72 000
Israel	*25 000	27 000	28 000	25 000	25 000
Japan	295 148	282 900	274 600	280 600	276 300
Kazakhstan	140 700	156 600	135 400	115 974	117 641
Korea, Dem. P.R. of	7 000	9 000	9 000	8 000	*7 000
Korea, Republic of	220 000	229 000	257 000	240 000	260 000
Malaysia	57 000	54 000	42 000	44 000	41 000
Pakistan	*2 000	*2 000	*2 000	*2 000	*2 000
Philippines	*27 000	*29 000	*30 000	*30 000	*34 000
Saudi Arabia	25 000	32 000	36 000	38 000	38 000
Taiwan	*56 000	*56 000	*55 000	*54 000	*54 000
Thailand	45 300	57 500	61 100	61 160	73 159
United Arab Emirates	2 000	2 000	*2 000	*2 000	*2 000

Production of refined lead

tonnes

Country	2003	2004	2005	2006	2007
Australia	309 000	274 000	267 000	241 000	237 000
New Zealand	*8 000	*8 000	*9 000	*11 000	*11 000
World Total	6 900 000	7 000 000	7 600 000	8 000 000	8 100 000

Note(s):-
(1) Figures relate to both primary and secondary refined lead and include the lead content of antimonial lead. Metal recovered from materials by remelting alone is excluded

(a) Including scrap for direct use
(b) Excluding Pb content of primary antimonial lead

Production of lithium minerals

tonnes

Country	2003	2004	2005	2006	2007
Portugal					
Lepidolite	24 606	28 696	26 185	28 497	34 755
Spain					
Lepidolite	6 333	3 226	6 751	8 339	9 000
Zimbabwe	12 131	13 710	37 499	...	...
Canada	*22 500	*22 500	*22 500	*22 500	*22 500
USA (a)	*1 500	*1 500	*1 500	*1 500	*1 500
Argentina (b) (c)	7 550	11 273	15 700	16 560	*17 000
Brazil					
Spodumene	9 755	9 064	8 924	8 585	7 991
Chile (c)	41 667	43 971	43 595	50 035	59 637
China	*35 000	*36 000	*37 000	*37 000	*38 000
Australia					
Spodumene	124 410	118 451	173 635	222 101	192 277
World Total (Li content)	14 100	15 200	17 100	18 300	20 000

Note(s):-
(1) In addition to the countries listed, Russia also produces lithium minerals

(a) Li content
(b) Chloride
(c) Carbonate

Production of magnesite

tonnes

Country	2003	2004	2005	2006	2007
Austria	766 525	715 459	693 754	769 188	811 556
Greece	542 800	552 300	471 000	463 277	351 414
Netherlands (c)	261 194	245 495	285 336	293 006	*300 000
Poland	27 200	57 900	55 300	63 000	65 000
Russia	2 600 000	*2 600 000	*2 600 000	*2 600 000	*2 600 000
Serbia and Montenegro	17 488	—	—	—	—
Slovakia	994 000	965 900	920 100	941 100	957 000
Spain	517 030	567 504	556 129	520 646	463 850
Turkey	3 224 278	3 732 952	2 372 206	2 088 033	*2 100 000
South Africa	86 100	65 900	54 800	*55 000	*55 000
Zimbabwe	822	749	864	939	*940
Canada (b)	*180 000	*180 000	*180 000	*180 000	*180 000
Brazil	306 444	366 174	386 759	382 718	399 314
Colombia	*10 500	*10 500	*10 500	*10 500	*10 500
China	12 000 000	13 310 000	15 440 000	13 640 000	*13 600 000
India (e)	323 977	383 953	340 674	241 920	237 546
Iran (a)	87 795	88 194	94 850	187 764	...
Korea, Dem. P.R. of	*1 200 000	*1 000 000	*1 000 000	*1 000 000	*1 000 000
Pakistan (d)	3 435	6 074	3 029	2 446	3 445
Philippines	3 799	3 201	2 413	3 630	3 600
Saudi Arabia	...	—	45 000	...	...
Australia	472 668	586 393	631 572	482 027	*344 000
World Total	23 600 000	25 400 000	26 100 000	23 900 000	23 500 000

Note(s):-
(1) In addition to the countries listed, Bulgaria is believed to produce magnesite

(a) Years ended 20 March following that stated
(b) Officially described as magnesitic dolomite and brucite
(c) Chloride produced from solution mining
(d) Years ended 30 June of that stated
(e) Years ended 31 March following that stated

Production of primary magnesium metal

tonnes

Country	2003	2004	2005	2006	2007
Russia	*30 000	*35 000	*38 000	*35 000	*33 000
Serbia	—	—	—	*500	*500
Serbia and Montenegro	*500	*500	*500	—	—
Ukraine	—	—	2 900	2 000	2 000
Canada	*50 000	*40 000	*45 000	*45 000	*45 000
USA	10 000	*30 000	*40 000	*40 000	*40 000
Brazil	4 000	3 000	3 000	5 000	3 000
China	341 800	442 400	467 600	525 600	659 300
India	*200	*200	*200	*200	*200
Israel	26 000	28 000	27 853	24 581	29 168
Kazakhstan (a)	14 164	18 000	20 000	21 000	*25 000

Note(s):-
(a) Not marketed as metal but used in titanium production

Production of manganese ore

tonnes

Country	2003	2004	2005	2006	2007
Bulgaria	4 200	27 800	38 500	20 500	27 900
Georgia (a)	173 500	218 500	251 800	328 643	*330 000
Hungary	48 000	49 000	50 000	50 000	51 000
Italy	763	714	632	...	...
Romania	72 931	79 130	72 000	60 107	49 350
Russia	44 400	44 400	*44 000	*44 000	*44 000
Turkey	18 000	13 751	4 751	...	...
Ukraine (a)	2 533 000	2 273 100	*2 000 000	*2 000 000	*2 000 000
Egypt	*20 000	46 450	22 971	*20 000	*20 000
Gabon	2 000 000	2 459 170	2 752 987	2 978 972	3 300 000
Ghana	1 509 432	1 597 085	1 719 589	1 578 128	1 173 486
Ivory Coast	—	—	*36 500	56 829	80 850
Morocco	18 064	9 000	10 000	2 500	41 600
Namibia	—	—	7 320	18 918	*19 000
South Africa					
Metallurgical	3 484 801	4 264 762	4 599 289	5 201 162	5 982 190
Chemical	15 837	17 194	12 810	12 176	12 950
Sudan	...	...	...	—	400
Mexico	312 506	381 982	371 054	344 662	418 342
Brazil	2 544 000	3 143 000	3 200 000	3 128 000	1 866 000
Chile	19 641	25 801	39 786	37 169	26 808
China	*4 600 000	*5 500 000	*7 500 000	*8 000 000	*8 000 000
India (c)	1 776 153	2 386 396	1 906 353	2 142 948	2 472 855
Iran (b)	115 680	128 924	114 708	70 471	...
Kazakhstan	2 361 000	2 318 100	2 207 700	2 531 100	2 482 000
Malaysia	...	...	—	6 500	56 500
Thailand	—	4 550	88 500	1 000	9 500
Australia	2 555 000	3 401 000	3 829 000	4 567 000	5 289 000
World Total	24 200 000	28 400 000	30 900 000	33 200 000	33 800 000

Note(s):-
(1) In addition to the countries listed, Colombia, Cuba and Vietnam are believed to produce manganese ore

(a) Marketable
(b) Years ended 20 March following that stated
(c) Years ended 31 March following that stated

Production of mercury

kilograms

Country	2003	2004	2005	2006	2007
Finland	25 000	23 500	34 200	22 820	45 000
Russia	*50 000	*50 000	*50 000	*50 000	*50 000
Spain	745 260	—	—	—	—
Algeria	175 570	67 200	300	—	—
Morocco	*10 000	*10 000	*10 000	*10 000	*10 000
Mexico	*15 000	*15 000	*15 000	*15 000	*15 000
USA	*15 000	*15 000	*15 000	*15 000	*15 000
Chile (a)	*50 000	*50 000	*50 000	*50 000	*50 000
China	612 000	1 140 000	1 094 000	800 000	*800 000
Kyrgyzstan	370 000	488 100	*400 000	*400 000	*400 000
Tajikistan	*30 000	*30 000	*30 000	*30 000	*30 000
World Total	2 100 000	1 900 000	1 700 000	1 400 000	1 400 000

Note(s):-
(1) Several countries are believed to have unrecorded production of mercury from copper electrowinning processes and by recovery from effluents

(a) From copper solvent extraction and electrowinning processes

Production of mica

tonnes

Country	2003	2004	2005	2006	2007
Finland	9 337	9 250	9 500	8 097	11 449
France (e)	18 000	19 000	*20 000	*20 000	*20 000
Russia	10 063	8 474	*9 000	*11 000	*12 000
Serbia	—	—	—	*140	*140
Serbia and Montenegro	185	140	*140	—	—
Spain (e)	11 800	7 825	4 043	4 496	4 300
Madagascar	*90	*90	*90	*90	*90
South Africa	980	285	924	828	419
Canada	*17 500	*17 500	*17 500	*17 500	*17 500
Mexico	506	424	120	150	9 600
USA (d) (e)	78 600	99 000	78 000	*110 000	*72 000
Argentina	1 894	2 518	4 101	6 223	*7 000
Brazil	*4 000	*4 000	*4 000	*4 000	*4 000
China (c)	*66 200	*92 000	*89 000	*94 000	*93 000
India (b)	4 002	3 773	2 116	1 411	1 264
Iran (f)	5 500	7 032	6 810	4 440	...
Korea, Republic of (a)	33 645	59 238	36 623	30 356	42 385
Malaysia (g)	3 609	3 544	4 544	5 152	6 118
Sri Lanka	1 674	1 365	1 800	2 600	3 224
Taiwan	3 237	2 979	8 608	4 841	3 387
Australia	636	383	737	—	—
World Total	270 000	340 000	300 000	330 000	310 000

Note(s):-
(1) In addition to the countries listed, Romania is believed to produce mica

(a) Mainly sericite
(b) Years ended 31 March following that stated
(c) Conservative BGS estimates, based on exports
(d) Sold or used by producers
(e) Including mica recovered from mica schists and/or kaolin beneficiation
(f) Years ended 20 March following that stated
(g) Sericite

Mine production of molybdenum

tonnes (metal content)

Country	2003	2004	2005	2006	2007
Armenia	2 763	2 950	3 030	4 090	4 295
Russia	4 800	4 800	4 800	4 800	*4 800
Canada	9 092	9 519	7 935	7 723	6 841
Mexico	3 524	3 731	4 245	2 519	6 491
USA	33 500	41 500	58 000	59 800	*59 400
Chile	33 375	41 883	47 885	43 158	41 528
Peru	9 561	14 246	17 325	17 209	16 787
China	32 220	38 430	*40 000	*43 900	*46 000
Iran (a)	2 290	1 890	2 476	3 574	*3 600
Kazakhstan	53	...	...	400	800
Kyrgyzstan	*250	*250	*250	*250	*250
Mongolia	1 803	1 103	1 188	1 404	1 978
Uzbekistan	*500	*500	*500	*500	*500
World Total	134 000	161 000	188 000	189 000	193 000

Note(s):-
(1) In addition to the countries listed, Australia, Georgia, India, Democratic P.R. of Korea, Romania and Tajikistan are believed to produce molybdenum

(a) Years ended 20 March following that stated

Production of nepheline syenite

tonnes

Country	2003	2004	2005	2006	2007
Norway	332 000	329 000	320 000	312 000	312 000
Russia (a)	1 014 279	1 023 257	*1 000 000	*1 000 000	*1 000 000
Canada	705 000	699 000	745 000	719 000	765 000

Note(s):-
(a) Nepheline concentrates

NICKEL

Characteristics

Nickel is hard and corrosion resistant and has a relatively high melting point of 1453°C, nearly as high as that of iron. It is, nevertheless, malleable and ductile allowing it to be readily worked into sheets or wire. It has excellent strength and toughness at extremes of temperature. It has low thermal and electrical conductivities, and is capable of being magnetised although not as strongly as iron. It is very durable as a pure metal, and alloys readily with many other metals.

Nickel occurs in the Earth's crust principally as oxides, sulphides and silicates. The majority of economic nickel deposits occur in two geological environments. These are magmatic sulphide deposits and lateritic deposits. Sulphide deposits may be formed during slow crystallisation of a magma body at depth or in ancient lava flows. The principal ore mineral is pentlandite [$(Ni,Fe)_9S_8$]. Nickel-bearing lateritic ores are formed by tropical and sub-tropical surface weathering. The principal ore minerals are nickeliferous limonite [(Fe,Ni)O(OH)] and garnierite (a hydrous nickel silicate). Mining exploits both sulphide and laterite ores in almost equal proportions although laterites currently account for around 70 per cent of known nickel resources. The rapid development of nickeliferous pig-iron production in China has made the economic exploitation of lower grade oxide ores possible.

Nickel ores are widespread, but the principal nickel mining countries are Russia, Canada, Australia, Indonesia, New Caledonia, Colombia and Brazil. Important nickel refineries treating imported raw materials operate in Norway, Finland, France, Japan and the United Kingdom.

Nickel is normally extracted from sulphide ores using pyrometallurgical processes (smelting) followed by electrolytic refining. Lateritic ores may be smelted directly to ferronickel or treated by hydrometallurgical leaching processes, using either ammonia or acids. New bioleaching methods are currently under development for the treatment of low-grade ores and waste dumps.

Primary nickel is marketed as nickel metal with varying purities, and as nickel oxides. Ferronickel, with a nickel content of 25 to 40 per cent, is an intermediate product that is added to alloy steel melts particularly in the production of stainless steel.

Nickel in the form of scrapped alloy steel or nickel-based alloy is readily recycled, and large tonnages of this material are used to supplement newly mined metal.

Uses

Nickel is used as pure metal only in electroplating applications for corrosion resistance e.g. medical equipment, scissors and cosmetic applications such as domestic fittings and vehicle parts, giving them a hard, tarnish-resistant surface. More than 80 per cent of nickel production is combined with other metals, especially iron, chromium and copper, to form alloys. Nickel adds toughness, strength, rust resistance and other electrical, magnetic and heat resistant properties. Stainless steels containing, typically, 8–12 per cent nickel, account for about two-thirds of nickel consumption (International Nickel Study Group, 2008) and are used in construction, the chemical and food-processing industries and household products. Nickel-based high-performance alloys are critical in the aerospace industry. Nickel is also used in the manufacture of rechargeable (nickel–cadmium) batteries, in computer hard discs, in coinage, jewellery and in electrical components.

World production in 2007

Nickel mine production reached a record total of 1632 thousand tonnes in 2007, an increase of 106 thousand tonnes, or seven per cent, from 2006. The largest producers of mined nickel with their share of world production are, in order, Russia (18 per cent), Canada (16 per cent), Indonesia (12 per cent), Australia (11 per cent), and New Caledonia (8 per cent). Indonesian nickel production has been steadily rising in recent times has increased by 24 per cent since 2003. However, Australian production has declined by four per cent since 2003, and this has led to Indonesia climbing above Australia to be the world's third largest mined nickel producer.

World refined nickel production also reached a record high of 1440 thousand tonnes in 2007, an increase of 103 thousand tonnes, or seven per cent on 2006. The largest producers with their share of world production were Russia (19 per cent), China (14 per cent), Canada (11 per cent), Japan (11 per cent), and Australia (8 per cent). Japanese output was entirely based on imported raw materials.

Countries with mainly lateritic nickel resources, such as Colombia, Indonesia and Brazil, are increasing production to levels comparable with the diminishing, but still substantial, magmatic sulphide resources in Russia, Canada and Australia.

The rise in nickel production has been driven in recent years by an increase in consumption in Western Europe and in China in particular, to supply its growing steel industry. However, the worldwide economic crisis in 2008 has curtailed this growth with reduced demand forecast for 2008 and continuing into 2009.

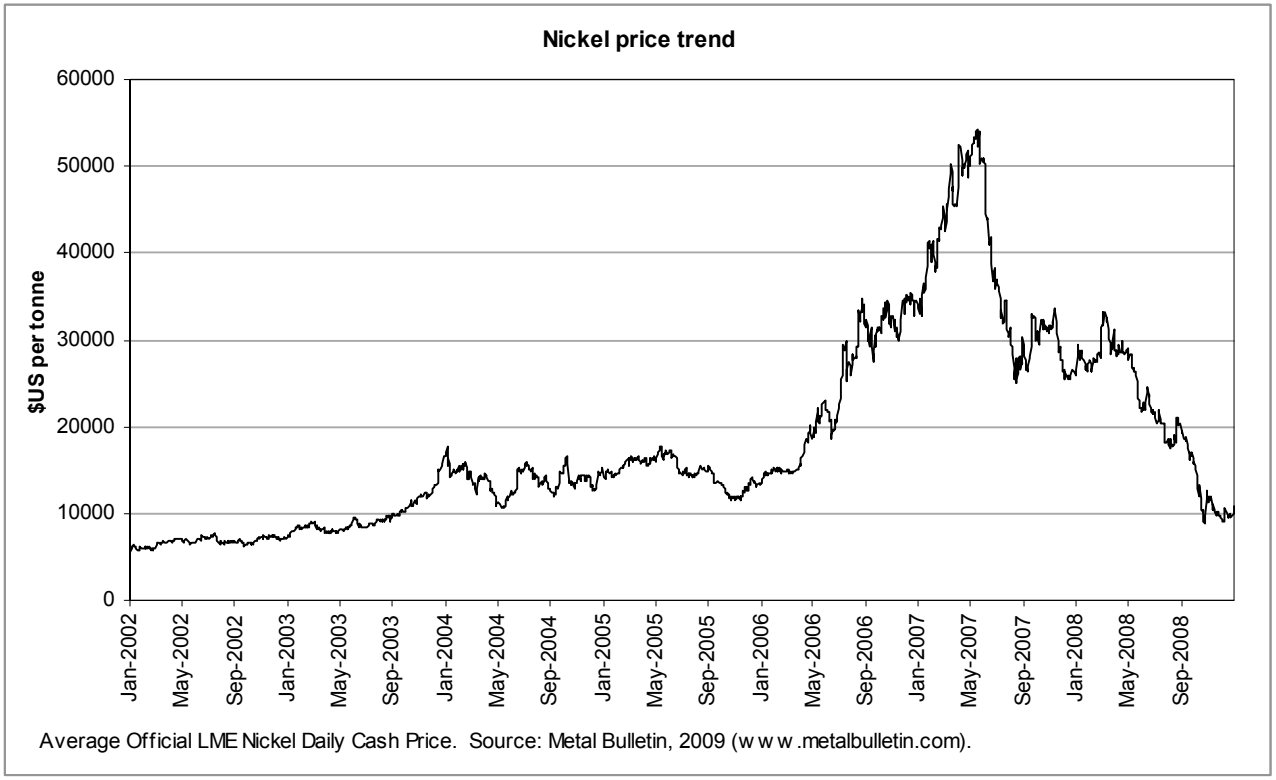
Prices

The price of nickel has experienced periods of volatility over the last twenty years. The price decrease in the first half of the 1990s was attributed to the economic collapse of the former 'Eastern Bloc' countries which caused a surge of nickel exports, driving down nickel prices below the cash costs of production and resulted in reduced nickel production in the 'West' (International Nickel Study Group, 2008a). Until 2003 the nickel cash price remained below US$10 000 per tonne. The price began to escalate dramatically from November 2005, continuing throughout 2006 and into 2007, reaching an all time high of US$54 200 per tonne in May 2007 before falling back by the end of the year.

The beginning of 2008 saw a gradual price increase, exceeding US$30 000 per tonne in March. However, from May until the end of the year the nickel price began a sustained fall as the world economic upheaval continued. The lower prices were caused by a fall in production and demand of stainless steel in most parts of the world, including China. The nickel price fell to a low of US$8 805 per tonne on 24th October, a fall of over 80 per cent from the high of US$54 200 per tonne on 16 May 2007, but had recovered slightly to end the year at just over US$10 800 per tonne (Metal Bulletin prices, 2009).

Industry events in 2008

The worldwide economic slowdown starting in the middle of the year had a dramatic impact on the nickel industry. Demand for nickel slumped and prices fell in tandem.



Average Official LME Nickel Daily Cash Price. Source: Metal Bulletin, 2009 (www.metalbulletin.com).

Norilsk Nickel, the Russian-based world's top producer of nickel, remained in the headlines during 2008. Earlier in the year Rusal, the Russian-based aluminium giant, acquired a 25 per cent stake in Norilsk. Rusal then became embroiled in a dispute with Norilsk regarding company performance, the composition of the Norilsk board and environmental practices. Norilsk's net profit fell by a third in the first half of the year, with major impact on its share price (Paxton and Budys, 2008). Norilsk later warned that its profits could fall by 75 per cent next year due to the falling nickel price, and hinted that further international operations could close (Haycock, 2008).

In other Norilsk news, the company announced in June that it had postponed a project to refine nickel in Botswana. The Tati nickel mine in Botswana, also owned by Norilsk, halted production for 12 days in late December due to a furnace breakdown at a smelter that processes its concentrate (Mining Journal, 2008a).

The deteriorating nickel price has caused the temporary closure of several mines around the world including some in Australia. The Avebury nickel mine, operated by Oz Minerals in Tasmania, is one example. The mine was commissioned during the first quarter of 2008 and was scheduled to produce 8500 tonnes of nickel per year. However, Oz Minerals placed the mine on care and maintenance in December 2008 until further notice (Oz Minerals, 2008). In December, operations were also suspended at the Miitel nickel mine in Western Australia, operated by Mincor Resources NL (Mining Journal, 2008b).

Norilsk's Cawse nickel laterite operation in Western Australia was also mothballed in October due to rising production costs and the falling nickel price. Production was also suspended at its Waterloo and Silver Swan mines, also in Western Australia, in late November (Mining Journal, 2008c).

Outside Australia, Industrial Metallurgical Holdings (IMH), a Russian-based nickel producer, closed two of its nickel plants in October, blaming weak demand and low prices (Metal Bulletin, 2008a). Meanwhile, French-based nickel producer Eramet planned to cut nickel output in 2008 to below 2007 levels, despite stating earlier in 2008 that output would rise by 10 per cent from last year (Metal Bulletin, 2008b).

In Finland, development at the Vammala nickel project, formerly worked by Outokumpu Oy and now owned by Australian-listed Dragon Mining, was suspended until at least May 2009 due to the low nickel price and poor near-term projection for nickel demand (Dudley, 2008).

In Canada, Xstrata Nickel announced plans to close the Craig and Thayer-Lindsley mines in Sudbury ahead of schedule and focus on two new, lower-cost nickel mines, the Nickel Rim South and Fraser Morgan mines, which are in advanced stages of development. The new mines, also located in the Sudbury area, are expected to be commissioned between late 2009 and early 2010 (Batten, 2008).

Brazil's Vale, the world's largest iron ore mining company and now owners of Inco, announced in October a plan to reduce output at some high-cost operations, including a 20 per cent cut in nickel output at its PT Inco unit in Indonesia. In addition, the continuing slide in the nickel price forced Vale to postpone various Canadian nickel projects including the Copper Cliff Deep project near Sudbury, as well as a month-long closure of the Voisey's Bay operations in Labrador, in July 2009 (Mining Journal, 2008d). However, development continued at Vale's Totten mine in Sudbury, which is projected to produce 8200 tonnes per year nickel, 11 200 tonnes per year copper, and 82 000 ounces of precious metals by mid 2011 (Inco, 2008a)

Vale also announced significant progress in the development of its Goro project in New Caledonia, including the completion of the Prony Bay port and the coal-fired power station. This deposit is reported to be one of the best undeveloped lateritic nickel deposits in the world and will produce an estimated 60 000 tonnes of nickel per year,

together with significant quantities of cobalt. Mining operations are scheduled to start in early 2009 (Inco, 2008b)

Several other companies involved in mining and processing lateritic nickel deposits have seen positive developments on their projects this year. These have included Toledo Mining Corp, an AIM-listed junior exploration company, which reported successful results of a study into heap leaching at its Berong nickel mine in the Philippines. European Nickel, another nickel laterite miner based in the UK, commenced initial open pit mining at its Çaldag operation in western Turkey in late 2007 and submitted an application for a forestry licence from the Turkish government in May (European Nickel, 2008). In addition, European Nickel and Perth-based Rusina Mining announced a successful pre-feasibility study for using heap leach technology at its Acoje deposit in the Philippines. European Nickel issued an updated JORC-compliant resource figure for this deposit of 34.41 million tonnes indicated resource at 1.09 per cent nickel (limonite plus saprolite), from an inferred plus indicated resource of 50.14 million tonnes at 1.06 per cent nickel using a cut off grade of 0.8 per cent nickel (European Nickel, 2008).

In a further boost to nickel laterite production, the massive Koniambo project in New Caledonia owned by Xstrata continues to progress with a view towards full mining commencing in 2013. The deposit has over 142 million tonnes of measured and indicated saprolite resources at 2.13 per cent nickel, 140.7 million tonnes of inferred saprolite resources, grading 2.16 per cent nickel, and 104 million tonnes of inferred limonite resources at 1.5 per cent nickel. Koniambo is forecast to operate for at least 25 years and be one of the lowest cost nickel producers in the world (Xstrata Nickel, 2008).

In another nickel laterite development, BHP Billiton cancelled a joint venture agreement with Indonesia's PT Antam to develop nickel laterite resources in eastern Indonesia, citing lack of an identified business case for the company (Jacoby, 2008).

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Mine production of nickel

tonnes (metal content)

Country	2003	2004	2005	2006	2007
Finland	3 400	3 400	3 400	3 000	3 600
Greece	19 100	19 000	20 400	21 700	21 200
Macedonia	5 600	5 300	8 100	10 900	15 000
Norway	—	382	342	320	240
Russia	291 000	290 000	*300 000	*300 000	*300 000
Spain	—	—	5 380	6 398	6 630
Turkey	500	—	700	1 900	*6 000
Ukraine	—	*6 000	*6 000	*12 000	*12 000
Botswana	27 400	22 292	28 212	26 762	22 844
South Africa (a)	40 842	39 851	42 497	41 599	37 877
Zimbabwe	6 678	9 776	7 799	8 825	9 500
Canada	163 244	186 694	198 932	232 948	254 784
Cuba	74 000	71 900	*73 800	74 000	75 200
Dominican Republic	45 253	46 000	*46 000	*46 500	*46 000
Brazil	45 456	44 928	74 198	82 492	58 317
Colombia	70 800	75 100	89 000	94 100	100 500
Venezuela	18 800	19 000	18 500	18 200	15 900
China	61 100	75 600	72 700	82 100	70 200
Indonesia	143 900	142 700	150 000	150 000	188 400
Kazakhstan	—	*300	*300	*300	*300
Philippines	19 537	16 973	22 560	64 705	78 154
Australia	191 000	187 000	189 000	185 000	184 000
New Caledonia	112 013	119 199	111 939	102 986	125 222
World Total	1 340 000	1 381 000	1 470 000	1 567 000	1 632 000

Note(s):-
(a) Includes metal and metal content of sulphate and concentrates

Smelter/refinery production of nickel

tonnes

Country	2003	2004	2005	2006	2007
Austria	*1 000	1 300	1 000	900	900
Finland	50 989	49 580	39 159	47 469	55 000
France	11 370	12 103	12 684	13 700	16 400
Greece	18 000	18 116	19 235	17 700	18 700
Macedonia	5 600	5 300	8 100	10 900	15 000
Norway	77 183	71 410	85 374	82 257	87 600
Russia	260 000	260 400	247 600	286 000	272 000
Ukraine	1 400	4 800	13 000	15 900	*20 000
United Kingdom	24 200	38 600	37 100	36 800	34 050
South Africa	40 800	39 851	42 392	37 000	34 400
Zimbabwe	16 300	16 200	15 900	13 200	14 000
Canada	124 418	151 518	139 683	153 743	162 646
Cuba	42 300	38 800	39 100	*42 000	*41 500
Dominican Republic	27 227	29 477	28 668	29 675	29 130
Brazil	30 514	32 101	36 315	36 569	34 954
Colombia	46 482	48 016	52 749	51 137	49 312
Venezuela	18 800	19 000	18 500	18 200	15 900
China	64 700	72 600	97 800	136 600	199 300
Indonesia	8 933	7 945	7 300	14 474	18 532
Japan	165 100	169 500	163 243	149 954	161 500
Australia	129 000	122 000	121 000	116 000	114 000
New Caledonia	50 666	43 016	46 738	48 723	44 954
World Total	1 215 000	1 252 000	1 273 000	1 359 000	1 440 000

Note(s):-
(1) Data relate to refined nickel plus the nickel content of ferro-nickel, nickel oxide and nickel salts

Production of perlite

tonnes

Country	2003	2004	2005	2006	2007
Armenia	106 623	29 996	49 963	*50 000	*50 000
Bulgaria	16 800	8 500	15 300	4 500	13 900
Georgia	*5 000	*5 000	*5 000	*5 000	*5 000
Greece	1 079 036	1 053 388	1 075 129	*1 100 000	*1 100 000
Hungary	95 100	65 000	69 900	71 019	67 542
Italy	*60 000	*60 000	*60 000	*60 000	*60 000
Russia	*45 000	*45 000	*45 000	*45 000	*45 000
Slovakia	15 000	23 840	8 630	10 560	20 000
Turkey	136 683	133 829	156 935	*160 000	*160 000
Ukraine	*24 000	*26 000	38 200	36 400	...
South Africa	*400	*400	*400	*400	*400
Mexico	194 463	188 027	91 724	81 719	54 405
USA	493 000	508 000	508 000	454 000	*444 000
Argentina	21 480	21 193	21 991	25 146	*26 000
China	*650 000	*700 000	*700 000	*1 380 000	*1 400 000
India (c)	279	355	122	68	—
Iran (b)	26 495	31 259	30 051	*30 000	*30 000
Japan	*240 000	*240 000	*240 000	*240 000	*240 000
Philippines	15 200	12 100	9 700	9 600	9 900
Thailand	5 700	26 400	14 500	22 000	6 400
Australia (a)	9 440	9 952	10 634	12 057	8 546
New Zealand	*5 000	5 600	7 310	3 552	7 873

Note(s):-
(1) In addition to the countries listed, Algeria, Canada, Iceland, Mozambique and former Yugoslavia are believed to produce perlite

(a) Years ended 30 June of that stated
(b) Years ended 20 March following that stated
(c) Years ended 31 March following that stated

Production of crude petroleum

tonnes

Country	2003	2004	2005	2006	2007
Albania	359 253	399 740	349 116	316 190	281 147
Austria	1 014 716	981 588	933 040	944 637	944 741
Azerbaijan	15 251 300	15 348 800	22 214 200	31 904 900	41 267 400
Belarus	1 820 400	1 804 040	1 785 020	1 780 040	1 760 020
Bulgaria	27 900	33 100	30 000	27 500	25 700
Croatia	1 052 121	1 037 787	980 486	950 859	911 207
Czech Republic	310 000	299 000	306 000	259 000	240 000
Denmark	18 341 000	19 446 000	18 822 000	17 068 000	15 551 000
Estonia (e)	1 463 000	1 314 000	1 690 000	1 624 000	1 901 600
France	1 219 000	1 288 000	1 179 000	1 100 000	1 013 000
Georgia	139 700	97 600	66 600	63 506	*62 000
Germany	3 799 864	3 515 537	3 572 764	3 514 284	3 414 590
Greece	143 000	143 000	135 000	93 000	...
Hungary	1 134 245	1 076 844	947 542	880 000	838 700
Italy	5 570 000	5 445 000	6 100 000	5 800 000	5 800 000
Lithuania	382 400	301 874	216 634	180 894	154 449
Netherlands	3 076 398	2 890 979	2 268 746	2 022 475	2 576 222
Norway	153 508 000	150 974 000	139 802 000	136 695 000	125 763 000
Poland	764 806	886 188	847 844	795 742	720 603
Romania	5 651 000	5 462 000	5 215 000	4 777 000	4 837 000
Russia	421 000 000	459 000 000	470 000 000	481 000 000	491 000 000
Serbia	—	—	—	654 288	639 089
Serbia and Montenegro	670 745	652 270	648 000	—	—
Slovakia	47 953	42 410	33 150	30 520	23 000
Spain	329 171	262 707	166 014	143 432	143 123
Turkey	2 375 082	2 275 529	2 280 764	2 175 353	1 783 199
Ukraine	3 966 900	4 314 200	4 413 800	4 506 000	4 459 000
United Kingdom	99 161 460	88 834 864	78 821 976	71 432 543	71 484 525
Algeria	76 841 000	81 760 000	84 821 000	85 036 000	*85 000 000
Angola	42 500 000	48 200 000	61 200 000	69 700 000	84 100 000
Cameroon	3 400 000	4 500 000	4 200 000	4 400 000	4 200 000
Chad	1 200 000	8 800 000	9 100 000	8 000 000	7 500 000
Congo	11 163 000	11 209 000	*11 480 000	*12 200 000	*10 400 000
Congo, Democratic Republic	1 256 000	1 380 000	1 230 000	1 230 000	*1 360 000
Egypt	36 800 000	35 400 000	33 990 000	33 700 000	34 100 000
Equatorial Guinea	12 000 000	17 100 000	18 500 000	17 700 000	18 000 000
Gabon	12 000 000	11 800 000	11 700 000	11 700 000	11 500 000
Ghana	351 000	351 000	301 000	301 000	301 000
Ivory Coast	1 652 000	1 754 000	1 954 000	3 106 000	2 605 000
Libya	69 000 000	76 600 000	82 100 000	85 600 000	86 000 000
Mauritania	—	—	—	1 523 000	752 557
Morocco	11 800	32 300	32 300	11 200	11 100
Nigeria	115 135 240	124 266 540	125 347 780	120 000 000	114 200 000
Senegal	39 200	27 300	50 600	52 400	42 900
South Africa	*780 000	1 060 000	1 113 500	721 000	502 000
Sudan	13 100 000	14 900 000	15 000 000	16 300 000	22 500 000
Tunisia	3 224 000	3 400 000	3 459 000	3 261 300	4 545 800
Barbados	50 899	51 696	47 861	47 133	*50 000
Canada	121 700 000	122 500 000	127 400 000	131 600 000	137 300 000
Cuba	3 679 800	3 253 000	2 935 100	2 900 000	2 905 000
Guatemala	1 252 104	1 024 000	933 000	816 000	774 500
Mexico	195 890 000	197 750 000	194 390 000	190 410 000	179 760 000
Trinidad & Tobago	6 914 300	6 332 472	7 444 890	7 355 280	6 183 900
USA	343 700 000	333 800 000	318 580 000	315 576 700	316 937 700
Argentina	39 307 638	35 910 829	34 117 773	33 806 223	32 959 940
Bolivia	1 551 000	1 891 000	1 957 000	1 888 000	1 907 000
Brazil	80 300 000	79 820 000	88 600 000	93 600 000	94 800 000
Chile	187 000	183 000	171 000	150 000	132 000
Colombia	27 907 653	27 200 000	27 100 000	27 200 000	27 400 000
Ecuador	21 414 000	26 826 000	27 085 000	27 291 000	26 021 000
Peru	4 501 500	4 637 000	5 484 000	5 696 000	5 612 000
Suriname	690 000	661 000	707 000	774 000	877 500
Venezuela	131 400 000	150 000 000	151 000 000	144 200 000	133 900 000

Production of crude petroleum

tonnes

Country	2003	2004	2005	2006	2007
Bahrain	1 870 000	1 867 000	1 822 000	1 790 000	1 721 000
Brunei	10 306 000	10 300 000	10 100 000	10 903 000	9 639 000
Burma	1 051 000	1 044 000	1 100 000	*1 000 000	900 000
China (a)	169 599 800	175 873 300	181 352 900	184 765 700	186 656 900
East Timor	—	168 000	136 000	119 000	57 000
India (d)	33 373 000	34 015 000	32 190 000	33 987 000	34 115 000
Indonesia	57 839 000	54 495 000	52 943 000	50 281 000	47 720 000
Iran	203 700 000	209 700 000	210 100 000	211 300 000	212 100 000
Iraq	66 100 000	100 000 000	90 000 000	98 100 000	105 300 000
Israel	3 736	3 155	3 114	3 500	11 700
Japan	757 000	783 000	834 000	818 000	876 000
Jordan	1 400	1 200	1 200	1 400	...
Kazakhstan	45 376 300	59 484 800	61 486 000	65 003 100	67 125 300
Kuwait (c)	114 800 000	122 300 000	129 300 000	132 400 000	129 600 000
Kyrgyzstan	69 500	73 800	100 000	100 000	100 000
Malaysia	35 200 000	36 400 000	33 600 000	31 900 000	32 600 000
Mongolia	25 000	29 700	28 000	52 000	117 000
Oman	40 800 000	38 900 000	38 600 000	36 730 000	35 370 000
Pakistan (b)	3 128 000	3 017 000	3 216 000	3 191 000	3 282 000
Philippines	690 000	624 000	721 000	784 000	*800 000
Qatar	40 800 000	46 000 000	47 300 000	50 900 000	53 600 000
Saudi Arabia (c)	485 100 000	506 000 000	526 800 000	514 300 000	493 100 000
Syria	26 200 000	24 700 000	22 531 000	19 427 500	18 600 000
Taiwan	45 760	44 563	32 389	23 564	17 778
Tajikistan	17 700	18 900	21 700	23 700	24 400
Thailand	8 600 000	8 300 000	9 900 000	11 400 000	11 500 000
Turkmenistan	10 000 000	9 600 000	9 500 000	9 200 000	9 800 000
United Arab Emirates	122 200 000	124 700 000	129 000 000	139 000 000	135 900 000
Uzbekistan	7 100 000	6 600 000	5 400 000	5 400 000	4 900 000
Vietnam	17 700 000	20 051 000	18 519 000	16 800 000	15 920 000
Yemen, Republic of	20 609 000	19 329 000	19 132 000	17 429 000	15 800 000
Australia	27 000 000	20 748 000	21 439 000	20 605 000	21 362 000
New Zealand	1 052 400	913 600	855 000	819 000	1 875 000
Papua New Guinea	2 282 000	1 984 000	2 191 000	2 290 000	2 107 000
World Total	3 677 000 000	3 841 000 000	3 878 000 000	3 899 000 000	3 885 000 000

Note(s):-
(1) The figures shown in this table include natural gas liquids

(a) Including oil from shale and coal
(b) Years ended 30 June of that stated
(c) Including shares of production from the Neutral Zone
(d) Years ended 31 March following that stated
(e) From oil shale

Production of natural gas

million m^3

Country	2003	2004	2005	2006	2007
Albania	12	12	11	11	10
Austria	2 029	2 011	1 654	1 765	1 835
Azerbaijan	5 128	4 995	5 732	6 080	10 832
Belarus	254	245	228	219	201
Bulgaria	11	333	573	519	295
Croatia	2 190	2 198	2 384	2 714	2 892
Czech Republic	131	175	356	148	148
Denmark	7 552	8 946	9 908	9 873	8 752
France	1 523	1 325	1 089	1 167	1 023
Georgia	18	11	15	21	...
Germany	22 202	20 381	19 143	19 798	18 075
Greece	27	23	16	*16	...
Hungary	3 145	3 112	3 041	3 254	2 653
Ireland, Republic of (b)	673	848	570	500	519
Italy	13 885	12 961	11 977	11 000	9 700
Netherlands	69 114	81 499	74 460	73 300	72 431
Norway	72 905	78 351	84 702	87 600	89 700
Poland	5 315	5 630	5 742	5 651	5 653
Romania	13 174	13 246	12 637	12 422	11 981
Russia	581 000	632 000	641 000	656 000	651 000
Serbia	—	—	—	280	274
Serbia and Montenegro	364	318	282	—	—
Slovakia	201	178	151	135	195
Slovenia	4 926	5 500	5 500	4 200	3 400
Spain	268	370	174	118	42
Turkey	276	344	484	307	248
Ukraine	19 333	20 192	20 787	21 094	21 104
United Kingdom	108 470	101 571	93 505	84 300	76 856
Algeria	82 829	82 009	89 235	88 209	*84 827
Angola	650	750	650	680	830
Egypt	25 000	26 900	34 600	44 700	46 500
Equatorial Guinea	1 220	1 390	2 300	2 000	*2 000
Gabon	125	102	100	100	*100
Ivory Coast	1 457	2 000	2 200	2 200	*2 200
Libya	5 500	8 060	11 300	13 195	15 280
Morocco	61	40	40	56	61
Nigeria	19 023	22 388	22 400	28 500	34 100
South Africa	*1 800	1 800	1 900	1 700	1 600
Tunisia	2 687	2 827	2 873	2 394	2 285
Canada	173 700	175 364	176 510	176 808	174 429
Cuba	658	704	743	1 091	1 218
Mexico	36 200	37 700	38 900	42 800	46 200
Trinidad & Tobago	25 774	29 628	33 270	40 082	41 766
USA (e)	541 000	526 000	511 000	523 000	546 000
Argentina	50 633	52 385	51 573	51 778	51 007
Bolivia	7 398	10 257	12 536	13 433	14 301
Brazil	10 900	11 900	12 200	12 700	12 710
Chile	2 181	2 106	2 394	2 199	2 015
Colombia	6 100	6 400	6 800	7 300	7 700
Ecuador	142	170	255	283	295
Peru	759	849	1 586	1 784	*2 700
Venezuela	25 200	28 400	28 100	27 900	28 500
Afghanistan	...	...	*50	*50	*50
Bahrain	11 799	11 595	12 692	13 436	11 433
Bangladesh (d)	11 926	12 827	13 605	14 921	15 920
Brunei	12 400	12 200	12 000	12 135	11 718
Burma	9 600	10 200	13 000	13 400	14 700
China	35 015	41 460	49 320	58 553	69 300
East Timor	—	*4 000	*4 000	4 132	4 826
India (c)	30 908	30 820	32 202	30 792	31 455
Indonesia	89 384	85 839	84 571	80 501	76 703
Iran	81 500	89 663	103 500	108 600	111 900
Iraq	1 560	1 000	1 450	1 450	1 460
Israel	8	1 192	1 656	2 313	2 758

Production of natural gas

million m^3

Country	2003	2004	2005	2006	2007
Japan	2 836	2 794	3 263	3 302	3 708
Jordan	288	294	242	251	220
Kazakhstan	7 557	11 598	14 023	26 382	29 562
Kuwait (a)	10 000	10 900	12 300	12 410	12 060
Kyrgyzstan	27	29	30	20	10
Malaysia	50 810	53 670	59 880	59 640	60 780
Oman	17 800	18 000	19 600	25 657	26 104
Pakistan (d)	28 107	34 058	38 085	39 645	40 028
Philippines	...	...	...	3 200	*3 200
Qatar	28 000	33 300	45 800	50 700	59 800
Saudi Arabia (a)	60 060	65 680	71 240	73 461	74 420
Syria	9 260	8 200	6 300	8 272	7 825
Taiwan	831	796	548	463	417
Tajikistan	32	34	27	18	15
Thailand	21 299	22 317	23 676	24 492	25 812
Turkmenistan	59 100	58 300	63 000	62 200	67 400
United Arab Emirates	44 800	46 290	47 790	48 790	50 290
Uzbekistan	58 100	59 900	59 700	55 400	58 500
Vietnam	2 712	6 269	6 440	7 000	7 700
Australia	33 180	35 257	37 129	38 885	39 955
New Zealand	4 529	4 115	3 862	3 983	4 310
Papua New Guinea	139	156	154	153	155
World Total	2 682 000	2 803 000	2 884 000	2 972 000	3 033 000

Note(s):-
(1) So far as possible the figures in this table exclude flared or reinjected gas

(a) Including one-half of the output of the Neutral Zone
(b) Sales
(c) Years ended 31 March following that stated
(d) Years ended 30 June of that stated
(e) Dry gas

Production of phosphate rock

tonnes

Country	2003	2004	2005	2006	2007
Finland	799 339	838 000	822 987	857 922	830 989
Russia	11 072 600	11 345 300	11 317 400	10 812 800	10 963 500
Algeria	905 000	784 000	902 300	1 510 233	1 800 025
Burkina Faso	2 400	2 400	*2 400	*2 400	*2 400
Egypt	2 183 200	2 218 900	3 269 538	2 176 900	2 504 000
Morocco	23 338 000	26 675 000	28 788 000	27 097 000	27 638 000
Senegal					
Phosphate rock	1 499 600	1 576 000	1 451 000	584 000	691 300
Aluminium phosphate (a)	3 516	1 600	1 520	1 500	*1 500
South Africa	2 642 970	2 735 150	2 576 885	2 628 714	2 555 723
Tanzania	3 738	6 570	7 096	2 881	8 261
Togo	1 471 200	1 115 200	1 047 893	1 156 500	750 100
Tunisia	7 889 900	8 050 800	8 220 400	7 838 000	8 002 000
Zimbabwe	80 034	83 391	45 705	65 838	54 800
Canada	980 500	1 064 000	888 000	530 000	618 700
Mexico	5 500	350	350	7 500	41 721
USA	35 000 000	35 800 000	36 300 000	30 100 000	29 700 000
Brazil (d)	5 583 778	5 689 000	5 631 000	5 932 000	6 185 000
Chile	21 300	21 465	20 363	13 836	25 073
Colombia	*43 000	*43 000	*43 000	*43 000	*43 000
Peru	11 610	45 504	—	—	—
Venezuela	260 008	300 057	392 000	400 000	*400 000
China	24 470 000	26 174 300	30 444 900	38 959 500	45 417 000
Christmas Island (b) (c) (e)	585 737	655 474	757 013	724 278	703 719
India (f)	1 435 959	1 722 983	2 049 277	1 584 140	1 853 000
Iran	224 000	229 575	284 166	—	—
Israel	3 707 000	3 290 000	3 236 000	2 949 000	3 069 000
Jordan	6 762 279	6 222 775	6 374 725	5 804 991	5 552 000
Kazakhstan	1 260 300	1 706 500	1 534 100	1 059 300	1 044 900
Korea, Dem. P.R. of	*100 000	*100 000	*100 000	*100 000	*100 000
Pakistan (e)	2 562	4 614	2 687	2 996	3 350
Philippines					
Phosphate rock	569	2 380	2 178	1 963	1 961
Guano	51	220	140	213	209
Sri Lanka	41 357	43 520	41 978	42 159	40 128
Syria	2 400 757	2 882 420	3 500 000	3 664 000	3 678 000
Thailand	13 870	2 580	3 020	900	3 550
Uzbekistan	433 400	482 000	468 000	573 000	599 500
Vietnam	821 000	905 000	1 024 200	1 232 400	1 419 100
Australia	2 286 247	2 015 597	1 935 630	2 083 454	2 131 045
Nauru (b)	112 900	*29 000	*18 000	*84 000	*200 000
World Total	138 000 000	145 000 000	154 000 000	151 000 000	159 000 000

Note(s):-
(1) In addition to the countries listed, Indonesia is believed to produce phosphate rock

(a) Including lime phosphates
(b) Exports
(c) Including phosphate dust
(d) Including beneficiated and directly shipped material
(e) Years ended 30 June of that stated
(f) Years ended 31 March following that stated

PLATINUM

Characteristics

Platinum is a rare, silvery greyish-white metal that is heavier than gold, corrosion resistant, and highly ductile. Platinum is part of the Platinum Group Metals (PGM) series, consisting of platinum, palladium, rhodium, ruthenium, osmium and iridium. These metals have certain similar chemical and physical properties and are relatively inert.

Platinum sometimes occurs as the native metal but more commonly occurs in alloys with the other PGM and other metals. Platinum also forms numerous minerals in combination with sulphur, antimony, arsenic, bismuth and tellurium. Among the most common platinum-bearing PGMs are sperrylite ($PtAs_2$), Pt-Fe alloys, cooperite (PtS), braggite (PtPdS) and moncheite ($PtTe_2$). Platinum deposits are rare and occur mainly in mafic and ultramafic igneous rocks in which they are concentrated by high-temperature magmatic processes. Secondary occurrences of platinum consist of placer deposits, which are produced from eroded igneous host rocks and concentrated by streams or rivers.

Many commercially exploited platinum deposits are associated with copper and/or nickel sulphides, such as chalcopyrite, pyrrhotite and pentlandite, or with chromite.

Uses

Approximately 50% of platinum produced is used within catalytic converters in vehicle exhaust systems where it helps to reduce pollutants. The other significant uses for platinum are in jewellery and in a wide range of industrial applications.

Platinum is often blended with palladium, which is much cheaper, when used in catalytic converters. However, increasingly stringent environmental legislation has led to rising demand for platinum since it is more effective than palladium in removing harmful gases from the combustion process. This is especially true for diesel engines that have recently gained in popularity in some countries and require a higher proportion of platinum in their catalysts than do petrol engines.

Platinum is also used extensively in jewellery. Platinum jewellery is traditionally most popular in Japan, although the rising use of white gold, which contains platinum, has increased demand in the West.

Platinum is increasingly used in a variety of industrial applications. These include the electronics industry, where the metal is used in hard disc drives and LCD monitors, and the chemical industry, where it is used in fertilisers, explosives and polymers. Platinum is also used within the pharmaceutical industry in anti-cancer drugs, as well as in oil refining. A growing, and potentially major future use of both platinum and palladium, is in fuel cells where electricity is produced as a by-product of a chemical reaction between hydrogen and oxygen catalysed by PGM.

World production in 2007

Global demand for platinum rose by 8.6 per cent to 7.03 million troy ounces in 2007 (Johnson Matthey, 2008a). However, production of platinum fell, principally due to lower production from South African mines caused by unscheduled maintenance shutdowns, safety concerns, geological problems and a labour disputes. World platinum output fell by 6000 kilograms to 498 000 kilograms, and this caused the platinum market to move from a surplus in 2006 to a deficit in 2007.

The largest producer of platinum remains South Africa, which accounts for almost 78 per cent of world production from the Bushveld Complex. Other major suppliers of platinum include Russia, from the Noril'sk operations, and the North American Stillwater Mine in Montana. Small quantities of platinum continue to be produced from Zimbabwe, the Lac des Iles mine in Canada, as a by-product of nickel mining in Australia, and in the Sudbury Basin, Ontario, Canada.

Production from South Africa rose slightly in 2007, as has generally been the case over the past few years. This increase is attributed to the continuing expansion of existing platinum mines as well as the recent start up of mothballed or new platinum mines coming on stream. These new mines include several on the eastern limb of the Bushveld Complex (e.g. Anglo Platinum's Twickenham and Lebowa mines), as well as the previously dormant Crocodile River mine (Impala) on the western limb.

Production in Russia remained constant, although a planned large-scale restructuring of its operations is expected to cause a slight dip in production next year. Production at Stillwater also increased slightly, though it also reported that production for 2008 was likely to be lower due to labour disputes.

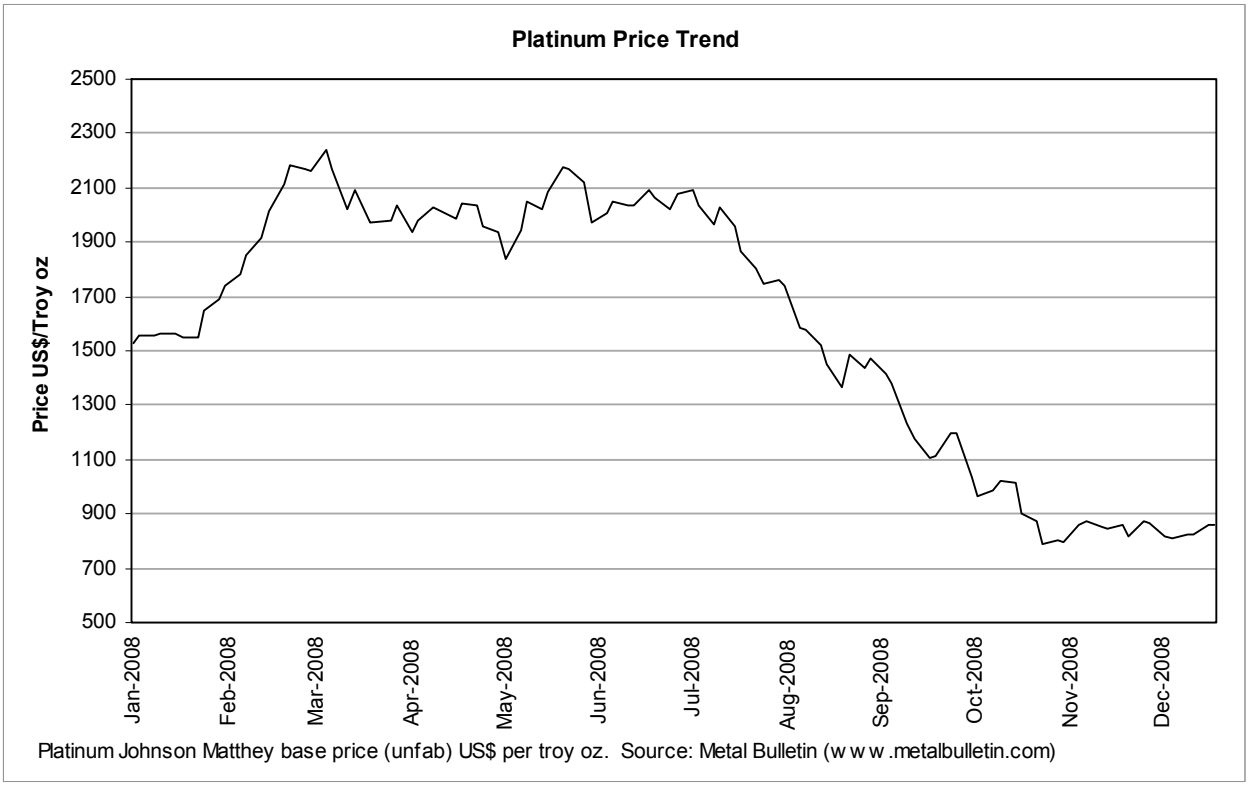
Elsewhere, platinum production remained fairly constant, though slightly less PGM was produced from the Australian mines, and the Canadian Lac des Iles operations are believed to have marginally increased PGM production, though this mine temporarily closed at the end of October 2008.

Prices

Unlike gold, platinum is an important and widely used metal in industry. Consequently the price of platinum is predominantly determined by normal supply and demand relationships, although movements in the gold price do have a marginal effect on the platinum price.

Platinum prices have experienced periods of volatility over the last decade. Throughout the 1990s, the price hovered around the US$400 per troy ounce mark, approximately US$250 per troy ounce lower than the highest price for platinum in the early 1980s. However, after legislation requiring automobiles to produce less pollution was introduced towards the end of the 20th Century, platinum, and subsequently also palladium, was discovered to be very efficient at removing harmful products from vehicle engines in catalytic converters. This led to a dramatic increase in the price of platinum from US$420 per troy ounce in August 2001, to just over US$1500 per troy ounce by December 2007.

Platinum prices continued to rise through the first quarter of 2008 and reached a record level of US$2276 per troy ounce in March 2008 (Metal Bulletin, 2009) attributed to a combination of rising demand, principally by vehicle manufacturers, and a shortage in supply. However, the global financial crisis, which began in the middle of the year, caused dramatic price falls in platinum due to a slowdown in vehicle production and investors selling stocks of physical platinum metal. By October the price had fallen by 60% to US$900 per troy ounce, and again to just over US$800 per troy ounce by mid-December (Metal Bulletin, 2009). Platinum's price briefly fell below the price of gold on 12th December for the first time in almost fifteen years (Mining Journal, 2008a) after the failure



Platinum Johnson Matthey base price (unfab) US$ per troy oz. Source: Metal Bulletin (w w w .metalbulletin.com)

of the Emergency Bill that was aimed to rescue the 'Big Three' car makers in the US. However, by the end of 2008, the price of platinum rallied slightly to around US$912 per troy ounce.

Industry events in 2008

The worldwide economic downturn had a major impact on the platinum industry in 2008. The rapid fall in the platinum price caused a slowdown in platinum exploration in the second half of the year. In addition, some mines have temporarily closed marginal parts of their operations and are re-evaluating further expansion of their existing operations. These events have led Johnson Matthey to forecast a 240 000 troy ounce supply deficit for 2008 (Johnson Matthey, 2008b).

The world's leading PGM producer, South Africa, continued to report supply disruptions caused by power shortages and safety concerns during 2008. A four day power outage in January, caused by a failure of South African energy utility Eskom to meet consumer demands, affected all mining activities in South Africa with enforced closures of mine shafts due to safety concerns. The world's largest producer of platinum, Anglo Platinum, reported a production loss of an estimated 30,000 troy ounces during January due to the continuing power problems, which are expecting to continue until 2012 despite 3000 MW of new coal-fired power stations coming on stream before 2010 (Grima, 2008). Anglo Platinum also reported a shutdown of its Polokwana smelter in November due to an incident where rainwater came into contact with furnace run-out. This incident was predicted to reduce Anglo's output by 150 000 to 200 000 troy ounces (Macharia, 2008).

Following the South African power shortages, a number of mining companies started negotiations with Eskom to secure the power needed to maintain operations and undertake planned expansions. This included Impala Platinum which is seeking to develop its Leeuwkop platinum project, situated on the western limb of the Bushveld Complex, as well as increasing capacity at its Marula platinum mine, due to come on stream by 2010 (Metal Bulletin, 2008).

Anglo Platinum also reported a number of other production setbacks in early 2008. These related to flooding at the Amandelbult Mine on the western limb of the Bushveld Complex, as well as labour disputes at the Rustenburg Section, Kroondal and Marikana Mines over a five-day period during the first quarter (Mining Magazine, July 2008). However, despite these challenges, the world's top platinum producer continued to report strong profits and posted record half-year headline earnings up 22 per cent from 2007, despite a 16 per cent fall in refined platinum production compared with the first half of 2007 to just over one million ounces (Anglo Platinum, 2008). The Twickenham Mine in South Africa, also owned by Anglo Platinum, received approval for an expansion programme to produce 250 000 tonnes per month, equivalent to 180 000 troy ounces per year, from the UG2 reef. However, subsequent to the dramatic fall in the price of platinum, Anglo Platinum announced that it was reducing capital expenditure by US$900 million by deferring spending on projects such as Twickenham, Styldrift and building a new shaft at Amandelbult mine (Onstad, 2008).

Attempted mergers and takeover activity have resulted in minor consolidation of the platinum industry in 2008. The first moves were made by Xstrata, the Swiss-based mining giant, which initiated a hostile US$10 billion takeover bid in August for Lonmin plc, the world's third biggest platinum producer. However, Xstrata abandoned this bid on October 1st, partly due to the fall in the platinum price.

Lonmin itself reported a 13 per cent fall in production rates in the first half of 2008 compared with the same time in 2007 due to a combination of the power supply disruptions and planned maintenance work on its Number One furnace. However, the company also reported a 134 per cent increase in production compared with 2007 figures from its mechanised Saffy and Hossy shafts. In addition, Lonmin's Limpopo phase 2 and Pandora projects completed pre-feasibility studies, and drilling

work completed on the Akanani project upgraded the indicated resource estimate for the southern P2 section to 8.8 million troy ounces of PGM (Mining Magazine, July 2008). However, later in the year, Lonmin also announced suspension of its open cast operations at Marikana and has announced that it is discussing the future of its Limpopo operation that is currently uneconomic (Mineweb, 2008a).

In other mergers and takeover news, Impala Platinum (Implats), second largest platinum producer in the world, launched a bid on 2nd October to buy Northam Platinum and Mvelaphanda Resources for US$2.47 Billion (Mineweb 2008b). Northam Platinum had earlier acquired the Booysendal property, which massively boosted its PGM resources to 120 million troy ounces. However, in mid-November, Implats subsequently withdraw from this offer due to changed economic circumstances (Mining Journal, 2008b). Implats then also stated that it had suspended its share buy-back programme and would review all of its capital expenditure plans (Mining Journal, 2008c).

In the first half of 2008 platinum exploration stepped up with many junior companies exploring properties on the Bushveld and Stillwater complexes, as well as the Urals and Kola Peninsula in Russia, and also in Canada. However, the fall in the platinum price in the second half of the year led to severe curtailment of this exploration.

The Crocodile River Mine, operating on the western limb of the Bushveld Complex in South Africa and owned by Eastern Platinum Ltd (Eastplats), has received approval from the South African Department of Minerals and Energy to expand its operation into the Crocette section of the mine. This will raise the mines production to its full target of 250,000 troy ounces per annum. However, the slump in platinum prices in the second half of the year forced Eastplats to delay this expansion and put the mine on care and maintenance (Mineweb, 2008c).

The Blue Ridge platinum project in South Africa, co-owned by Ridge Mining plc and Imbani Platinum, was due to be commissioned during December 2008 but postponed this to the end of January due to a minor accident at the site (Mineweb, 2008d). The project 5.34 million troy ounces of PGM within the Measured, Indicated and Inferred Resource categories, and is planned to produce 149 000 troy ounces of PGM per year (Ridge Mining, 2008).

In April, Wesize Platinum Ltd announced plans to develop its Frichgewaagd-Ledig platinum project in South Africa after successfully completing a bankable feasibility study. The resource estimate at this property is reported as 82.1 million tonnes at an average grade of 5.10 grams per tonne PGM containing 13.47 million troy ounces PGM. The project is estimated to cost US$564 million to develop. In full production the mine will produce an average of 350 000 troy ounces of PGM per annum (Dixon, 2008a). However, due to deteriorating economic conditions later in the year, Wesizwe decided to increase the time taken to develop the project, which would now go ahead in a series of stages, rather than a single project. (Mining Journal, 2008d).

Further evidence of a bright future for platinum was provided by Platinum Australia's decision to begin commissioning the processing plant at its South African Smokey Hills platinum mine, with initial mining commencing in January and commissioning beginning in September 2008. The mine is forecast to produce 95 000 troy ounces of PGE for seven years with full production due to start in the first quarter of 2009 (Platinum Australia, 2008).

Other mines affected by the downturn in the platinum price include Aquarius Platinum's Everest mine in South Africa, which was forced to close in December for at least six months with the loss of 1950 jobs (Mineweb, 2008e). Also in South Africa, Lonmin announced that the Messina platinum mine was to be placed on care and maintenance, as well as more than 4000 job losses at its Western Platinum and Eastern Platinum mines.

Outside South Africa, Zimplats' Ngzi expansion project in Zimbabwe is uncertain following an announcement by South African majority shareholder Implats that it had run out of funds to continue the project and was trying to raise additional money from investors abroad (Mineweb, 2008f).

Inco's production of platinum produced as a by-product from nickel mining in its Sudbury mines rose by 2.6 per cent to 44 000 troy ounces in the third quarter of 2008 compared with the same time in 2007. This represents an 11.2 per cent increase for the nine months of 2008 compared with 2007 (INCO, 2008)

Stillwater Mining, currently America's only PGM mine, announced that it was shedding 21 per cent of its workforce following restructuring at its Montana PGM mining and metallurgical operations (Kosich, 2008b). The majority shareholder of Stillwater Mining, Russia-based Norilsk Nickel, also stated earlier in the year that it was looking for a buyer for its 55.4 per cent stake in the company (Kosich, 2008a).

However, Stillwater may not be the USA's only PGM for much longer. Franconia Minerals Corp has reported an updated resource estimate for its Birch Lake Cu-Ni-PGE project in Minnesota which records an indicated resource of 108.2 million tonnes at 0.53 per cent Cu, 0.16 per cent Ni, and 1.01 grams per tonne Pt+Pd+Au, as well as a further 87.3 million tonnes of Inferred Resource of similar grades (Franconia Minerals, 2008). A preliminary economic assessment to examine the viability of a stand-alone 20 000 tonnes per day operation with a mine life of 20 years is to be carried out in early 2009 (Dixon, 2008b).

Anglo Platinum also announced that it had taken a 12 per cent stake in Magma Metals Ltd, an Australian Junior, which owns the Thunder Bay North project in northern Canada (Williams, 2008). Magma Metals has been carrying out a 24,000 metre diamond-drilling programme, and has announced promising grades of PGM in borehole intercepts. This programme is due to be completed in the first quarter of 2009 (Louthean, 2008).

Marathon PGM Corporation, a Canada-based PGM junior exploration company, announced in December a positive outcome for a feasibility study on its Marathon project in Ontario, Canada. This study identified 79.3 million tonnes within the Proven and Probable Resource categories at an average grade of 0.27 per cent Cu, 0.079 grams per tonne Au, and 0.99 grams per tonne of Pt+Pd. The company is now pursuing funding towards developing the mine (Marathon PGM Corp, 2008).

Platina Resources Ltd, an Australia-listed PGM junior exploration company, continued to explore properties on the Skaergaard Complex in Greenland. Initial results from a pre-feasibility study completed in July proved positive and further pre-feasibility work is due for completion by July 2010. Currently the Inferred Resource is 106.8 million tonnes at 2.32 grams per tonne of gold, palladium and platinum (Platina Resources, 2008).

Gold Fields, the world's fourth largest gold producer, took full control of the Arctic Platinum Project, Finland, in September (Mineweb, 2008g). The deposit, which has been known for several years and is described as similar to the Lac des Iles deposit in Canada, was previously worked by Gold Fields in 2005 but was shelved due to spiralling costs. Gold Fields initially aimed to prove a deposit containing five million troy ounces of platinum, palladium and gold, with a minimum grade of three grams per tonne (Mineweb, 2005). However, drilling in 2005 recorded grades of 1.85 grams per tonne of PGM, which at the time were deemed uneconomic (Tredway, 2005).

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Mine production of platinum group metals

kilograms (metal content)

Country	2003	2004	2005	2006	2007
Russia					
Platinum	27 400	*28 000	29 000	29 000	23 000
Palladium	92 000	97 000	97 400	98 400	96 800
Other platinum metals	*15 000	*15 000	*15 500	*15 600	*14 500
South Africa					
Platinum	148 348	153 239	168 749	168 125	165 835
Palladium	70 946	76 403	84 908	86 265	86 461
Other platinum metals	46 856	46 759	58 218	53 138	58 623
Zimbabwe					
Platinum	2 330	4 438	4 833	4 998	*5 000
Palladium	1 770	3 564	3 879	4 022	*4 000
Other platinum metals	441	810	862	874	*870
Canada					
Platinum	7 200	*9 100	*7 900	*8 000	*8 100
Palladium	11 500	*16 000	*13 800	*14 000	*14 100
Other platinum metals	800	*1 000	*900	*900	*900
USA					
Platinum	4 168	4 043	3 919	4 292	3 857
Palladium	13 996	13 654	13 312	14 401	13 312
Colombia	841	1 209	1 082	1 438	1 526
Australia					
Platinum	133	196	58	...	...
Palladium	477	846	603	(a) 959	(a) 742
World Total	444 000	471 000	505 000	504 000	498 000

Note(s):-
(1) Wherever possible, figures relate to quantities of platinum group metals thought to be recovered from ores originating in the country stated
(2) Figures for metal production are only given for countries where recovery is thought to be based predominantly on domestic materials or on imported materials which have not been recorded as mine production elsewhere in the table
(3) In addition to the countries listed, Bulgaria, China, Ethiopia, Indonesia and Philippines are believed to produce platinum group metals

(a) Platinum group metals; all forms

Production of potash

tonnes (K_20 content)

Country	2003	2004	2005	2006	2007
Belarus	4 229 000	4 612 000	4 928 000	4 605 300	4 971 600
Germany					
Potassic salts	3 563 932	3 626 510	3 663 829	3 624 977	3 636 504
Russia	4 653 300	5 599 100	6 265 600	5 274 100	6 373 100
Spain					
Chloride	505 527	553 210	494 594	493 189	530 700
Ukraine	*60 000	*50 000	*65 000	*65 000	*65 000
United Kingdom					
Chloride	621 400	539 500	439 200	427 000	430 000
Canada					
Chloride	9 093 000	10 332 000	10 140 000	8 528 000	11 426 000
USA					
Potassic salts	1 100 000	1 200 000	1 200 000	1 100 000	*1 200 000
Brazil					
Chloride	415 549	403 080	404 871	403 080	471 333
Chile					
Chloride	563 000	559 000	547 000	515 000	533 000
China	*450 000	*450 000	450 000	*490 000	*585 000
Israel					
Chloride	1 958 400	2 138 400	2 224 200	2 187 000	2 182 000
Jordan	1 176 690	1 157 360	1 097 487	1 020 000	1 067 000
World Total	28 400 000	31 200 000	31 900 000	28 700 000	33 500 000

Production of rare earth minerals

tonnes

Country	2003	2004	2005	2006	2007
Brazil					
Monazite	—	731	958	958	1 173
China (a)	92 000	98 300	119 000	119 000	*120 000
India					
Monazite (b)	2 891	149	122	...	...
Malaysia					
Monazite	795	1 683	320	894	682

Note(s):-
(1) With the exception of the data for USA and China, figures in this table refer to gross tonnage of concentrates
(2) In addition to the countries listed, rare earth minerals are believed to be produced in Indonesia, Kazakhstan, Democratic P.R. of Korea, Republic of Korea, Kyrgyzstan, Mozambique, Nigeria, Russia, Vietnam

(a) REO content. Assumed to be 60% of concentrates produced
(b) Years ended 31 March following that stated

Production of salt

tonnes

Country	2003	2004	2005	2006	2007
Albania					
Sea salt	21 448	24 783	47 219	*47 000	*47 000
Armenia	31 854	31 625	34 682	37 000	35 000
Austria					
Rock salt	1 610	1 228	1 497	1 336	1 172
Salt in brine	723 286	745 670	771 455	764 103	735 724
Azerbaijan	7 645	9 234	11 202	12 000	7 100
Belarus	1 543 136	1 883 138	1 839 300	2 075 693	1 665 350
Bosnia & Herzegovina	179 299	260 456	392 940	416 305	502 565
Bulgaria	1 882 000	1 900 000	1 900 000	2 000 000	2 000 000
Croatia	32 533	32 723	36 970	29 589	32 536
Denmark	*600 000	*600 000	*600 000	*600 000	*600 000
France					
Rock salt	320 000	406 000	494 000	...	...
Brine salt	1 409 000	1 433 000	1 468 000	...	...
Salt in brine	4 351 000	4 408 000	4 750 780	(k) 9 371 000	(k) 6 139 840
Sea salt	1 302 000	1 365 000	1 026 000	...	...
Germany					
Rock salt	6 178 000	7 268 000	8 258 000	9 280 000	4 826 000
Brine salt	1 123 000	974 000	1 006 000	1 001 000	1 010 000
Salt in brine	6 668 000	7 212 000	7 449 000	7 189 000	7 558 000
Greece	192 161	187 522	198 024	*200 000	*200 000
Italy					
Rock salt & brine salt	2 922 251	2 876 469	2 988 051	*3 000 000	*2 000 000
Montenegro					
Sea salt	—	—	—	5 000	20 000
Netherlands	5 980 000	5 896 000	6 155 000	6 056 000	6 177 000
Poland					
Rock salt	847 880	1 099 072	1 123 219	1 129 875	591 240
Brine salt	2 790 996	2 940 169	2 889 941	2 899 076	2 930 726
Portugal					
Rock salt	602 035	661 704	597 945	586 190	590 588
Sea salt	86 603	75 400	92 495	76 858	64 048
Romania	2 416 970	2 399 956	2 442 640	2 621 129	2 475 324
Russia	*2 800 000	*2 800 000	*2 800 000	*2 800 000	*2 800 000
Serbia	—	—	—	29 847	30 023
Serbia and Montenegro					
Rock salt	15 413	10 344	...	—	—
Sea salt	36 469	22 239	...	—	—
Slovakia	133 100	121 600	105 100	122 500	117 000
Slovenia	3 632	2 852	803	1 624	3 029
Spain					
Rock salt	2 562 832	2 656 904	2 909 526	2 809 046	2 800 000
Sea salt	1 327 108	1 227 625	1 368 960	1 506 343	1 450 000
Other salt	97 730	108 733	121 461	115 826	110 000
Switzerland	461 000	486 000	539 000	525 000	341 000
Turkey					
Rock salt	10 205	6 100	512	...	...
Sea salt	556 652	582 440	529 235	*500 000	*500 000
Other salt	1 675 915	1 569 178	1 196 486	*1 200 000	*1 200 000
Ukraine	2 906 400	4 393 000	4 811 000	5 996 000	5 548 000
United Kingdom					
Rock salt	*1 700 000	*2 000 000	*2 000 000	*2 000 000	*2 000 000
Brine salt	*1 000 000	*1 000 000	*1 000 000	*1 000 000	*1 000 000
Salt in brine (a)	*3 200 000	*2 800 000	*2 800 000	*2 800 000	*2 800 000
Algeria					
Brine salt & sea salt	241 000	241 800	302 700	259 596	183 189
Angola	*30 000	*30 000	*30 000	35 000	35 000
Benin (c)	*15 000	*15 000	*15 000	*15 000	*15 000
Botswana	229 432	208 319	243 945	151 595	165 710
Burkina Faso	*5 000	*5 000	*5 000	*5 000	*5 000
Cape Verde	*1 600	*1 600	*1 600	*1 600	*1 600
Djibouti	137 000	26 000	*78 000	*138 000	*138 000
Egypt (j)	*1 341 000	1 532 362	...	*1 500 000	*1 500 000
Eritrea	52 414	30 754	6 300	9 737	7 448
Ethiopia (d) (h)	61 000	21 000	24 202	19 271	*19 000
Ghana	*250 000	*265 000	250 000	250 000	*250 000

Production of salt

tonnes

Country	2003	2004	2005	2006	2007
Guinea	*15 000	*15 000	*15 000	*15 000	*15 000
Kenya (h)	21 199	31 139	26 595	35 024	11 596
Libya	*40 000	*40 000	*40 000	*40 000	*40 000
Madagascar	50 000	55 000	65 000	70 000	70 000
Mali	*6 000	*6 000	*6 000	*6 000	*6 000
Mauritania	*15	*20	*20	310	420
Mauritius (c)	7 200	7 000	7 900	7 408	6 650
Morocco	236 443	277 600	351 100	319 900	215 800
Mozambique (c)	*80 000	*80 000	*80 000	*80 000	*80 000
Namibia	651 431	750 821	573 248	603 501	*600 000
Niger	*2 000	*2 000	1 269	*1 300	*1 300
Senegal	235 000	167 800	134 000	198 600	212 300
Sierra Leone	1 004	—	—	—	—
Somalia	*1 000	*1 000	*1 000	*1 000	*1 000
South Africa	437 896	332 673	399 087	464 909	407 079
Sudan	*84 000	*84 000	*84 000	11 638	22 922
Tanzania	58 978	57 062	51 166	34 798	35 224
Tunisia (c)	899 000	1 117 000	1 132 000	1 127 000	933 000
Uganda	*5 000	*5 000	*5 000	*5 000	*5 000
Bahamas	1 245 447	1 284 294	1 470 176	1 143 000	578 000
Canada					
Rock salt	11 957 298	12 071 303	11 448 141	11 504 207	*10 045 000
Other salt (e)	1 994 490	2 052 333	2 047 653	1 901 453	*1 770 000
Costa Rica	*37 000	*37 000	*37 000	*37 000	*37 000
Cuba	*180 000	205 613	172 592	198 200	179 500
Dominican Republic					
Sea salt	*50 000	*50 000	*50 000	*50 000	*50 000
El Salvador (c)	31 366	*31 000	*31 000	*31 000	*31 000
Guatemala (c)	*60 000	*60 000	*60 000	*60 000	*60 000
Honduras	*26 000	*26 000	*26 000	*26 000	*26 000
Mexico	7 546 987	8 565 520	9 507 623	8 371 353	8 859 809
Netherlands Antilles	*400 000	*500 000	*500 000	*500 000	*500 000
Nicaragua (c)	31 320	*52 000	*52 000	*50 000	*50 000
Panama (c)	13 182	18 592	19 429	19 080	20 315
USA					
Rock salt (f)	16 300 000	18 300 000	*17 600 000	*16 500 000	*14 900 000
Salt in brine (f)	20 000 000	20 500 000	*20 700 000	*19 500 000	*19 600 000
Evaporated salt (f)	7 400 000	7 620 000	*6 800 000	*6 360 000	*7 360 000
Argentina	1 667 829	1 371 792	1 845 833	1 917 656	*2 000 000
Brazil					
Rock salt	1 420 000	1 442 000	1 559 000	1 622 000	1 621 000
Sea salt	5 144 000	5 205 968	5 519 618	5 122 197	5 365 091
Chile	6 213 473	4 938 928	6 067 583	4 580 471	4 403 743
Colombia					
Rock salt	207 486	232 460	215 905	248 245	204 090
Sea salt	244 053	302 101	445 562	389 630	309 557
Ecuador	*90 000	*90 000	*90 000	*90 000	*90 000
Peru	187 416	248 898	*250 000	*250 000	*250 000
Venezuela (c)	*350 000	*350 000	*350 000	*350 000	*350 000
Afghanistan	*13 000	*13 000	*12 000	*12 000	*12 000
Bangladesh (j)	585 000	620 000	650 000	*650 000	*650 000
Burma (b) (c)	*35 000	*35 000	*35 000	*35 000	*35 000
Cambodia	36 000	86 600	90 963	59 000	76 651
China	34 377 000	40 434 400	46 610 600	56 631 300	59 755 300
India					
Rock salt	1 000	3 800	1 800	1 600	*1 100
Sea salt	11 787 300	11 949 500	15 484 600	13 156 300	*13 000 000
Other salt	3 094 100	2 807 900	4 437 500	4 927 900	*5 000 000
Indonesia	*680 000	*680 000	*680 000	*700 000	*700 000
Iran (g)	1 553 526	1 791 000	2 032 445	2 617 902	*2 600 000
Iraq	50 000	*50 000	*25 000	*25 000	*25 000
Israel (c)	540 000	570 000	570 000	*640 000	...
Japan (i)	1 263 000	1 225 000	1 227 000	1 166 000	1 138 000
Jordan	11 976	21 727	29 500	28 800	...
Kazakhstan	282 389	347 850	178 167	416 680	227 643

Production of salt

tonnes

Country	2003	2004	2005	2006	2007
Korea, Dem. P.R. of	*500 000	*500 000	*500 000	*500 000	*500 000
Korea, Republic of	154 641	340 828	378 887	285 568	249 515
Kuwait	44 700	*45 000	*50 000	*50 000	*50 000
Laos	16 130	*15 000	34 139	*35 000	*9 000
Lebanon	15 000	15 000	*15 000	*15 000	*15 000
Mongolia	*100 000	*100 000	*100 000	*100 000	*100 000
Oman	12 300	12 400	10 900	*11 000	*11 000
Pakistan					
Rock salt (j)	1 426 067	1 639 516	1 648 223	1 858 931	1 872 664
Sea salt (j)	16 652	11 555	14 375	15 249	10 616
Philippines (c)	429 160	427 615	420 950	418 210	437 689
Saudi Arabia					
Rock salt & brine salt	547 000	*550 000	*550 000	...	...
Sri Lanka	81 791	78 135	85 179	87 560	70 209
Syria	128 265	141 445	110 000	133 000	81 000
Taiwan	178 826	159 091	114 389	107 713	107 720
Tajikistan	59 739	59 495	65 992	51 956	47 180
Thailand					
Rock salt	892 243	1 031 200	1 074 214	1 008 251	1 134 931
Other salt	*100 000	*100 000	*100 000	*100 000	*100 000
Turkmenistan	*215 000	*215 000	*215 000	*215 000	*215 000
Uzbekistan	*60 000	*60 000	*60 000	*60 000	*60 000
Vietnam	909 000	906 000	898 000	842 000	920 000
Yemen, Republic of	86 000	39 000	47 000	53 000	*60 000
Australia (l)	10 560 000	11 221 000	12 299 000	11 364 000	10 801 000
New Zealand	108 460	94 010	*90 000	83 000	102 000
World Total	219 600 000	233 800 000	250 000 000	256 000 000	247 700 000

Note(s):-
(1) This table does not include production of refined salt
(2) Salt is known to be produced in many countries for which statistics are not available.

(a) Used for purposes other than salt-making
(b) Brine salt
(c) Sea salt
(d) Years ended 7 July of that stated
(e) Including salt in brine
(f) Sold or used by producers
(g) Years ended 20 March following that stated
(h) Lake salt
(i) Years ended 31 March following that stated
(j) Years ended 30 June of that stated
(k) Salt; all forms
(l) Excluding Victoria and the Northern Territory

Production of selenium metal

tonnes

Country	2003	2004	2005	2006	2007
Belgium	*200	*200	*200	*200	*200
Finland	52	65	66	70	52
Germany	*14	*14	*12	12	12
Poland	78	83	82	87	*90
Russia	81	85	100	110	110
Serbia and Montenegro	7	—	—	—	—
Sweden	107	131	122	135	130
Canada	253	277	107	117	62
Peru	72	76	70	75	59
China	*65	*65	*65	*65	*65
India (a)	2	—	8	—	—
Japan	734	599	625	730	806
Kazakhstan	*40	*40	*40	*40	*40
Philippines	*45	*48	*68	*65	*65
Uzbekistan	*20	*20	*20	*20	*20

Note(s):-
(1) In addition to the countries listed, Australia, Chile, the Republic of Korea and Zimbabwe are believed to produce selenium metal

(a) Years ended 31 March following that stated

Production of sillimanite minerals

tonnes

Country	2003	2004	2005	2006	2007
France					
Andalusite	62 000	68 000	*65 000	*65 000	*65 000
South Africa					
Andalusite	164 921	234 625	228 375	*230 000	*230 000
Zimbabwe					
Kyanite	5 707	491	—	—	—
USA					
Kyanite (b)	90 000	90 000	*90 000	*90 000	*90 000
Brazil					
Kyanite (c)	*200	*200	*200	*200	*200
India					
Kyanite (a)	9 057	8 208	8 869	8 145	4 645
Sillimanite (a)	19 729	30 711	33 119	26 656	41 453
Australia					
Sillimanite	206	71	38	—	—

Note(s):-
(1) A number of other countries produce sillimanite minerals but details of output are not reported
(2) In addition to the countries listed above as producing sillimanite minerals, synthetic mullite is known to be produced in Denmark, France, Hungary and the United Kingdom

(a) Years ended 31 March following that stated
(b) Including related minerals
(c) Including beneficiated and directly shipped material

Mine production of silver

kilograms (metal content)

Country	2003	2004	2005	2006	2007
Armenia	*4 000	*4 000	*4 000	*4 000	*4 000
Bulgaria	*60 000	*60 000	*60 000	*60 000	*60 000
Finland	*12 000	*13 000	*13 000	*13 000	*13 000
France	495	682	—	—	—
Greece	7 000	—	2 300	25 500	38 300
Ireland, Republic of	8 500	5 200	10 500	12 900	10 000
Italy	200	100	100	—	—
Macedonia	22 195	—	—	*10 000	*30 000
Poland	1 332 200	1 372 700	1 262 400	1 265 100	1 244 000
Portugal	21 100	24 400	23 786	20 078	26 514
Romania	*18 000	*18 000	*18 000	*18 000	*18 000
Russia (a)	*700 000	1 276 900	*1 350 000	*1 250 000	*1 200 000
Serbia (a)	—	—	—	*2 400	*2 400
Serbia and Montenegro (a)	2 028	2 275	*2 400	—	—
Spain	2 173	3 583	5 227	2 369	—
Sweden	340 701	319 563	309 933	292 255	323 171
Turkey	158 000	122 000	219 000	220 000	*220 000
Algeria	500	—	800	500	500
Congo, Democratic Republic	35 700	69 700	53 600	67 600	76 200
Ethiopia (b)	999	1 133	883	902	900
Ghana	3 080	3 035	3 571	3 142	*3 100
Morocco	200 430	196 000	210 000	186 000	*186 000
Namibia (a)	29 367	27 153	34 102	31 307	*8 000
South Africa	87 325	73 124	89 023	86 951	70 089
Sudan	2 800	2 900	*2 900	2 437	2 405
Tanzania	7 986	13 216	12 891	14 906	12 381
Tunisia	*3 000	*2 000	*4 000	—	—
Zimbabwe	2 483	3 216	3 400	*1 000	*1 100
Canada	1 310 153	1 337 465	1 123 837	995 024	862 401
Costa Rica	—	—	196	685	304
Honduras	50 884	48 217	53 617	55 036	53 894
Mexico	2 568 877	2 569 478	2 894 161	3 028 395	3 135 430
Nicaragua	2 040	2 950	2 936	2 929	3 420
USA	1 239 400	1 246 100	1 225 800	1 139 500	1 170 000
Argentina	133 907	172 400	263 766	248 227	255 600
Bolivia	466 300	412 550	420 300	472 210	525 000
Brazil	6 496	6 192	6 672	10 000	18 620
Chile	1 312 789	1 360 140	1 399 539	1 607 164	1 936 467
Colombia	9 511	8 542	7 142	8 399	9 766
Peru	2 910 922	3 059 829	3 193 146	3 470 661	3 493 090
Burma (a) (c)	*800	*1 100	*2 300	*700	*700
China	2 400 000	2 450 000	2 500 000	*2 600 000	*2 700 000
India (c)	37 870	10 955	27 961	53 229	*81 000
Indonesia	285 206	262 935	328 749	261 398	268 967
Iran	*23 000	*25 000	*25 000	*30 000	*40 000
Japan	99 162	85 999	54 100	11 500	—
Kazakhstan (a)	804 874	707 443	812 095	796 234	707 954
Korea, Dem. P.R. of	*50 000	*50 000	*50 000	*50 000	*50 000
Korea, Republic of	15 417	50 866	41 489	56 256	57 369
Laos	3 850	2 735	3 405	6 331	4 499
Malaysia	—	364	402	410	296
Mongolia	20 471	20 427	19 888	20 378	*23 000
Philippines	9 533	9 315	19 150	23 502	27 754
Saudi Arabia	11 000	14 494	13 501	9 103	*9 000
Uzbekistan	*60 000	*60 000	*60 000	*60 000	*60 000

Mine production of silver

kilograms (metal content)

Country	2003	2004	2005	2006	2007
Australia	1 868 000	2 209 000	2 417 000	1 727 000	1 880 000
Fiji	1 247	1 523	1 418	494	—
New Zealand	29 932	*30 100	43 003	27 221	10 568
Papua New Guinea	61 900	53 800	51 125	51 098	52 500
World Total	18 856 000	19 884 000	20 758 000	20 413 000	20 988 000

Note(s):-
(1) Countries producing less than 1000 kg per year include Jamaica, Oman and Thailand

(a) Smelter and/or refinery production
(b) Years ended 7 July of that stated
(c) Years ended 31 March following that stated

Production of natural sodium carbonate

tonnes

Country	2003	2004	2005	2006	2007
Botswana	234 520	263 358	279 085	255 677	279 625
Ethiopia (a)	4 377	6 550	2 771	2 389	*2 000
Kenya	352 560	353 835	360 161	374 210	386 578
USA	10 600 000	11 000 000	11 000 000	1 100 000	*11 100 000

Note(s):-
(a) Years ended 7 July of that stated

Production of strontium minerals

tonnes

Country	2003	2004	2005	2006	2007
Spain	152 383	206 001	336 630	280 195	142 512
Turkey	*70 000	*60 000	*60 000	*12 000	*9 000
Morocco	2 700	*2 700	2 700	*2 700	*2 700
Mexico	130 329	87 610	110 833	128 321	96 902
Argentina (a)	4 300	6 727	7 233	19 822	*20 000
China	*500 000	500 000	700 000	*700 000	*700 000
Iran	2 100	7 500	672	17 170	...
Pakistan (b)	27	570	1 855	1 290	1 641

Note(s):-
(1) In addition to the countries listed, Germany and Poland are believed to produce strontium minerals

(a) May contain unbeneficiated material
(b) Years ended 30 June of that stated

Production of sulphur and pyrites

tonnes (sulphur content)

Country	2003	2004	2005	2006	2007
Austria					
Recovered (d)	50 568	55 322	54 377	50 097	50 501
Belarus					
Recovered (d)	22 292	32 288	48 663	38 567	41 031
Belgium					
Recovered (c) (d)	383 000	371 000	376 000	391 000	396 000
Bulgaria					
Recovered (c)	260 000	301 000	312 000	340 000	343 000
Recovered (d)	30 000	25 000	30 000	35 000	35 000
Croatia					
Recovered (d)	7 471	9 000	9 000	7 000	9 000
Czech Republic					
Recovered (d)	45 000	60 000	65 000	65 000	65 000
Denmark					
Recovered (d)	4 751	4 660	4 223	4 142	3 896
Finland					
Pyrites	276 200	283 700	184 400	199 700	194 300
Recovered (c)	328 779	325 523	304 751	325 793	*326 000
Recovered (d)	61 000	65 000	70 000	70 000	125 000
France					
Recovered (d)	710 400	698 400	622 345	616 234	605 820
Recovered (e)	196 000	150 000	127 000	75 000	75 000
Germany					
Recovered (d)	1 619 900	1 526 700	1 627 900	1 706 200	1 650 100
Recovered (e)	43 900	40 000	42 900	42 500	35 900
Greece					
Recovered (d)	162 000	160 000	162 000	162 000	165 000
Hungary					
Recovered (d)	51 000	35 000	65 000	50 000	65 000
Italy					
Recovered (c)	127 000	113 000	92 000	87 000	84 000
Recovered (d)	565 000	575 000	650 000	680 000	650 000
Lithuania					
Recovered (d)	48 515	67 094	74 276	61 135	42 618
Macedonia					
Recovered (c)	7 000	—	—	—	—
Netherlands					
Recovered (c)	131 000	137 000	141 000	141 000	141 000
Recovered (d)	408 000	410 000	440 000	495 000	505 000
Norway					
Recovered (c)	105 000	*105 000	*110 000	*110 000	*95 000
Recovered (d)	20 000	18 000	19 000	20 000	18 000
Poland					
Frasch	762 689	821 489	801 799	800 200	833 600
Recovered (c)	293 700	289 100	289 000	308 000	*310 000
Recovered (d)	181 900	182 000	186 600	203 100	*205 300
Portugal					
Recovered	27 000	25 000	30 000	38 000	27 000
Romania					
Recovered	49 000	53 000	79 000	60 000	64 000
Russia					
Pyrites	357 000	286 000	304 000	198 000	194 000
Recovered (d)	5 804 740	5 909 958	6 301 000	6 346 000	6 372 000
Recovered (e)	523 000	572 000	640 000	738 000	790 000
Serbia					
Recovered (c)	—	—	—	21 000	21 000
Serbia and Montenegro					
Recovered (c)	83 000	82 000	88 000	—	—
Slovakia					
Recovered (c)	5 000	5 000	5 000	5 000	5 000
Recovered (d)	60 000	65 000	65 000	65 000	78 000
Spain					
Recovered (c)	560 000	488 000	541 000	547 000	543 000
Recovered (d)	145 000	145 000	*150 000	*150 000	*150 000
Sweden					
Recovered (c)	180 200	185 800	180 000	180 000	177 000
Recovered (d)	62 454	62 238	59 839	68 391	66 569

Production of sulphur and pyrites

tonnes (sulphur content)

Country	2003	2004	2005	2006	2007
Turkey					
Pyrites	28 000	20 000	55 000	59 000	61 000
Recovered (d) (e)	94 000	68 000	76 000	73 000	73 000
Ukraine					
Sulphur ore	142 000	136 000	139 000	133 000	131 000
United Kingdom					
Recovered (c)	4 800	—	—	—	—
Recovered (d)	115 000	120 000	124 000	115 000	130 000
Algeria					
Recovered (d)	19 000	20 000	20 000	19 000	20 000
Egypt					
Recovered (d)	78 000	78 000	78 000	80 000	80 000
Libya					
Recovered (d)	*50 000	*50 000	*50 000	50 000	150 000
Namibia					
Pyrites	15 893	1 829	518	—	—
South Africa					
Pyrites	175 621	165 207	133 245	...	...
Recovered	264 077	179 776	220 254	*220 000	*220 000
Recovered	174 195	288 435	422 314	*420 000	*420 000
Zambia					
Recovered (c)	52 000	52 000	52 000	75 000	98 000
Zimbabwe					
Pyrites	19 000	42 400	20 041	39 777	...
Canada					
Recovered (c)	992 000	1 089 000	1 057 632	1 176 429	1 185 274
Recovered (d)	8 036 000	7 995 795	7 914 616	7 905 870	7 782 303
Cuba					
Recovered (d)	*5 000	*5 000	*5 000	*5 000	*5 000
Mexico					
Recovered (c)	539 000	703 000	703 000	621 000	621 000
Recovered (d)	1 051 968	1 121 546	1 016 000	1 077 000	1 027 000
Netherlands Antilles					
Recovered (d)	23 000	28 000	40 000	60 000	60 000
Trinidad & Tobago					
Recovered (d)	29 000	17 000	16 000	15 000	13 000
USA					
Recovered (c)	683 000	739 000	711 000	674 000	*670 000
Recovered (d)	8 970 000	9 420 000	8 790 000	*8 380 000	*8 150 000
Argentina					
Recovered (c)	23 000	23 000	23 000	23 000	23 000
Brazil					
Pyrites	19 246	24 174	19 618	20 954	22 336
Recovered (c)	285 824	279 631	266 817	297 539	321 707
Recovered (d)	90 332	91 804	112 093	117 203	135 623
Chile					
Recovered (c)	1 426 000	1 507 000	1 788 000	1 574 000	1 699 000
Colombia					
Recovered (d)	23 660	*24 000	*24 000	*24 000	*24 000
Sulphur ore	73 024	97 586	64 660	30 018	—
Ecuador					
Recovered (d)	*20 700	*20 700	*20 700	*21 000	*21 000
Sulphur ore	*4 000	*4 000	*4 000	*4 000	*4 000
Peru					
Recovered (c)	*60 000	*60 000	*60 000	*60 000	*60 000
Venezuela					
Recovered (d)	560 000	730 000	950 000	950 000	850 000

Production of sulphur and pyrites

tonnes (sulphur content)

Country	2003	2004	2005	2006	2007
Abu Dhabi					
Recovered (d)	1 925 000	1 926 000	2 060 000	2 045 000	2 183 000
Bahrain					
Recovered (d)	63 507	74 850	71 518	64 565	71 771
China					
Pyrites	3 974 000	4 029 000	4 011 000	3 986 500	*4 122 000
Recovered	2 637 000	3 070 000	3 195 000	3 588 000	4 308 000
Sulphur ore	700 000	827 000	950 000	1 000 000	1 150 000
India					
Recovered (c)	539 000	539 000	637 000	801 000	955 000
Recovered (d) (e)	451 000	501 000	576 000	801 000	951 000
Indonesia					
Recovered (c)	212 000	172 000	212 000	168 000	—
Recovered (d)	95 000	100 000	105 000	105 000	105 000
Iran					
Recovered (d)	1 310 000	1 400 000	1 440 000	1 440 000	1 456 000
Iraq					
Recovered (d)	150 000	100 000	100 000	100 000	100 000
Israel					
Recovered (d)	45 000	42 000	44 000	42 000	34 000
Japan					
Recovered (b) (c)	1 528 000	1 545 000	1 583 000	1 679 000	1 747 000
Recovered (d)	1 952 000	1 894 000	1 972 000	1 950 000	1 967 000
Kazakhstan					
Recovered (c)	327 000	351 000	235 000	*235 000	*235 000
Recovered (d)	1 585 000	1 625 000	1 590 000	1 586 600	1 660 700
Korea, Dem. P.R. of					
Pyrites	18 000	18 000	18 000	18 000	18 000
Recovered (c)	16 000	16 000	16 000	16 000	16 000
Korea, Republic of					
Recovered (c)	747 000	796 000	861 000	899 000	2 790 000
Recovered (d)	660 000	660 000	660 000	660 000	*670 000
Kuwait					
Recovered (d)	714 000	682 000	836 000	742 000	830 000
Oman					
Recovered (d)	*30 000	*30 000	*30 000	*30 000	*30 000
Pakistan					
Recovered (a)	19 402	23 873	24 158	24 730	27 710
Philippines					
Recovered (c)	162 000	163 000	163 000	180 000	196 000
Recovered (d)	30 000	40 000	45 000	45 000	45 000
Qatar					
Recovered (d)	272 274	307 187	450 000	395 000	420 000
Saudi Arabia					
Recovered (d)	2 179 000	2 249 000	2 700 000	2 900 000	2 900 000
Singapore					
Recovered (d)	180 000	215 000	250 000	250 000	212 000
Syria					
Recovered (d)	30 000	34 996	36 074	43 000	40 650
Taiwan					
Recovered	225 006	222 670	267 790	245 789	249 156
Thailand					
Recovered (c)	46 000	90 000	88 000	46 000	57 000
Recovered (d)	170 000	200 000	200 000	200 000	200 000
Uzbekistan					
Recovered (c)	163 000	163 000	163 000	163 000	163 000
Recovered (d)	360 000	360 000	345 000	345 000	345 000

Production of sulphur and pyrites

tonnes (sulphur content)

Country	2003	2004	2005	2006	2007
Australia					
Recovered (c)	863 000	850 000	915 000	915 000	980 000
Recovered (d)	60 000	60 000	60 000	60 000	60 000
New Zealand					
Recovered	26 000	21 000	29 000	29 000	32 000
World Total					
Pyrites	4 900 000	4 900 000	4 700 000	4 700 000	4 800 000
Frasch	800 000	800 000	800 000	800 000	800 000
Recovered	56 800 000	58 600 000	60 600 000	61 100 000	64 200 000
Sulphur ore	900 000	1 100 000	1 200 000	1 200 000	1 300 000

Note(s):-
(a) Years ended 30 June of that stated
(b) Including S content of sulphur ore
(c) From metal sulphide processing
(d) From petroleum refining and/or natural gas
(e) Other

Production of talc

tonnes

Country	2003	2004	2005	2006	2007
Austria	137 596	136 305	166 569	159 447	153 409
Finland	501 658	528 943	508 169	547 146	535 882
France	394 000	402 000	416 000	*420 000	*420 000
Germany	3 859	...	...	...	...
Greece	500	200	250	*250	*250
Italy	81 568	111 887	140 581	146 942	112 080
Macedonia	3 271	4 350	1 955	1 025	1 775
Norway	48 000	32 000	34 000	*34 000	*34 000
Portugal	5 460	6 231	5 362	5 517	12 367
Romania	10 082	9 725	6 760	2 967	1 513
Russia	129 888	154 138	*150 000	*150 000	*150 000
Slovakia	4 200	7 100	200	—	—
Spain					
Talc	101 739	107 829	90 589	83 502	85 000
Pyrophyllite	900	700	700	—	—
Sweden	7 000	8 000	7 000	6 000	7 000
United Kingdom	6 494	3 881	6 000	4 325	2 850
Egypt (d)	*40 000	50 210	54 609	*55 000	*55 000
Morocco					
Talc	1 959	*2 200	—	1 400	900
Pyrophyllite	28 338	45 600	33 300	12 900	26 100
South Africa					
Talc	6 719	8 141	8 469	10 966	14 281
Pyrophyllite	14 350	28 987	60 267	74 886	123 666
Sudan	...	...	...	216	2 620
Zimbabwe	196	—	—	—	—
Canada	87 000	81 000	70 000	68 000	67 000
Guatemala	1 585	2 863	16 131	526	*500
Mexico	114 870	101 896	64 827	40 535	32 410
USA	840 000	833 000	856 000	895 000	*839 000
Argentina					
Talc	1 700	7 620	12 603	13 773	*13 800
Pyrophyllite	4 525	12 594	8 470	9 340	*9 500
Brazil (b)	369 000	409 946	413 340	389 391	401 204
Chile	840	722	886	704	764
Colombia (b)	*15 000	*15 000	*15 000	*15 000	*15 000

Production of talc

tonnes

Country	2003	2004	2005	2006	2007
Peru					
Talc	10 791	8 312	14 251	14 618	23 096
Pyrophyllite	12 291	14 282	10 100	14 500	23 086
Uruguay	1 095	1 042	1 131	1 544	848
Bhutan	23 101	39 797	42 791	54 208	62 014
China	2 600 000	2 700 000	2 700 000	2 500 000	*2 500 000
India					
Pyrophyllite (e)	176 240	271 225	182 526	149 698	197 089
Steatite (e)	726 398	684 440	681 534	687 056	816 290
Iran (a)	65 833	108 541	70 600	69 050	70 000
Japan					
Talc	24 328	18 253	25 491	*25 000	*25 000
Pyrophyllite	408 435	405 222	351 111	*300 000	*250 000
Korea, Dem. P.R. of	*50 000	*50 000	*50 000	*50 000	*50 000
Korea, Republic of					
Talc	47 911	79 313	83 471	64 118	9 557
Pyrophyllite	912 285	827 895	885 559	677 465	798 054
Nepal (c)	6 905	3 435	5 832	6 648	9 043
Pakistan (d)	65 813	52 483	20 564	21 065	27 400
Taiwan	466	410	—	—	—
Thailand					
Talc	8 501	12 592	10 270	4 373	3 508
Pyrophyllite	73 556	108 691	177 684	131 843	415 420
Vietnam					
Pyrophyllite	*8 000	*10 000	*12 000	*14 000	*16 000
Australia (d)	165 980	123 080	150 923	*151 000	*151 000
World Total	8 400 000	8 600 000	8 600 000	8 100 000	8 600 000

Note(s):-
(a) Years ended 20 March following that stated
(b) Including talc, agalmatolite and pyrophyllite
(c) Years ended 15 July of that stated
(d) Years ended 30 June of that stated
(e) Years ended 31 March following that stated

Production of tantalum and niobium minerals

tonnes

Country	2003	2004	2005	2006	2007
Burundi					
Columbite-tantalite	24	23	43	16	52
Congo, Democratic Republic					
Columbite-tantalite	113	74	124	120	*120
Ethiopia					
Tantalite (a)	58	71	93	109	*100
Madagascar					
Columbite	...	40	...	...	...
Mozambique					
Tantalite	189	712	281	80	*80
Nigeria					
Tantalite	26	24	*25	25	*25
Rwanda					
Columbite-tantalite	187	220	276	188	242
Uganda					
Columbite-tantalite	16	0	0	0	0
Zimbabwe					
Columbite-tantalite	231	27	—	—	—
Canada					
Pyrochlore	*7 700	*8 200	*6 900	*9 200	*9 700
Tantalite	203	209	233	204	165
Brazil					
Pyrochlore	*66 000	*79 000	*146 000	*175 000	*215 000
Columbite-tantalite	*6 200	*6 500	*6 600	*5 400	*5 000
China					
Columbite-tantalite	*350	*350	*350	*350	*350
Malaysia					
Struverite	2 619	121	552	93	52
Australia					
Tantalite	*2 300	*2 400	*2 500	*1 400	*1 040
World Total concentrates	86 200	98 000	164 000	192 200	231 900
Nb content	29 800	27 400	42 300	52 200	71 100
Ta content	1 800	1 500	1 700	1 100	900

Note(s):-
(1) Niobium and tantalum minerals are believed to be produced in Namibia, Russia and South Africa.
(2) The figures in this table refer to gross tonnage of tantalum and niobium concentrates
(3) Tantalum is also recovered from tin slags and is believed to have accounted for approximately 20% of raw material supplied.

(a) Years ended 7 July of that stated

Production of tellurium metal

tonnes

Country	2003	2004	2005	2006	2007
Canada	40	69	11	11	8
USA	50	50	50	50	50
Peru	26	25	33	37	35
Japan	33	33	23	24	20

Note(s):-
(1) In addition to the countries listed, Germany is believed to produce tellurium metal

Mine production of tin

tonnes (metal content)

Country	2003	2004	2005	2006	2007
Portugal	203	200	243	25	41
Russia (b)	3 700	3 000	2 500	2 600	2 800
Burundi	5	9	4	44	28
Congo, Democratic Republic	2 600	6 800	7 600	7 200	12 000
Niger	5	4	14	13	11
Nigeria	891	1 374	*1 500	1 423	*2 500
Rwanda	1 458	3 554	4 532	3 835	4 566
Bolivia	16 386	18 115	18 639	17 669	15 972
Brazil	12 217	12 202	11 739	9 528	12 596
Peru (a)	40 202	41 613	42 145	38 470	39 019
Burma	600	500	700	*900	*900
China	101 800	118 200	121 600	126 300	136 300
Indonesia	66 284	73 079	78 400	80 900	66 137
Kazakhstan	13	14	5	—	—
Laos	420	*400	*600	*600	700
Malaysia	3 358	2 745	2 857	2 398	2 263
Thailand	980	724	188	225	149
Vietnam	*2 100	*3 500	*5 400	*5 400	*5 400
Australia	3 819	1 306	2 713	2 783	2 071
World Total	257 000	287 000	301 000	300 000	303 000

Note(s):-
(a) Recoverable
(b) Metal

Smelter production of tin

tonnes

Country	2003	2004	2005	2006	2007
Belgium	7 700	8 900	7 700	8 000	8 400
Russia	3 700	3 000	2 500	2 600	2 800
Nigeria	801	—	—	—	—
Bolivia (a)	12 836	13 627	13 841	14 100	12 300
Brazil	10 761	11 512	8 986	8 780	9 987
Peru	39 181	40 624	36 733	40 495	36 004
China	98 100	115 300	121 800	129 400	147 100
Indonesia	66 280	60 690	67 600	65 360	64 127
Malaysia	18 211	33 900	37 782	22 850	25 563
Thailand	15 200	20 800	31 600	27 540	23 104
Vietnam	1 915	2 356	2 510	2 665	2 861
Australia	597	467	594	572	118
World Total	275 000	311 000	332 000	322 000	332 000

Note(s):-
(1) Figures relate to both primary and secondary metal
(2) In addition to the countries listed, many countries produce small amounts of secondary metal

(a) Refined, including alloys

Production of titanium minerals

tonnes

Country	2003	2004	2005	2006	2007
Norway					
Ilmenite	859 000	866 700	806 800	850 000	882 000
Ukraine					
Ilmenite	*600 000	*600 000	*550 000	*600 000	*600 000
Rutile	*100 000	*100 000	*90 000	*100 000	*100 000
Egypt					
Ilmenite	125 000	120 000	*120 000	*120 000	*120 000
Sierra Leone					
Ilmenite	—	—	—	13 819	15 750
Rutile	—	—	—	73 600	82 805
South Africa					
Ilmenite (b)	*1 581 000	1 730 000	1 904 000	*2 070 000	*2 248 000
Rutile	*100 000	*100 000	*130 000	*125 200	*111 500
Canada					
Ilmenite (a) (b)	*1 900 000	*2 100 000	*2 100 000	*2 400 000	*2 500 000
USA	500 000	*500 000	*500 000	*500 000	*500 000
Brazil					
Ilmenite	120 160	133 000	127 142	*130 000	130 000
Rutile	*2 500	*3 000	2 782	*3 000	3 000
China					
Ilmenite	*840 000	*840 000	*1 015 000	*1 300 000	*1 300 000
India					
Ilmenite (d)	589 829	632 025	711 843	657 479	*730 000
Rutile (d)	19 646	19 648	20 299	16 159	*22 000
Kazakhstan	9 300	11 670	*10 000	13 500	15 700
Korea, Republic of					
Ilmenite	114 660	150 744	157 433	179 982	193 953
Malaysia					
Ilmenite	95 148	61 471	38 195	45 649	59 310
Rutile	18 472	27 308	5 509	16 921	1 450
Sri Lanka					
Ilmenite	—	1 335	36 303	57 033	70 728
Rutile	—	2 798	8 162	2 280	4 607
Vietnam					
Ilmenite (c)	*320 000	*580 000	*530 000	*600 000	*650 000
Rutile	*500	*500	*500	*500	*500
Australia					
Ilmenite	2 006 000	1 934 000	2 034 000	2 378 000	2 339 000
Rutile	173 000	162 000	177 000	232 000	312 000
Leucoxene	57 000	44 000	62 000	135 000	164 000
World Total					
Ilmenite (wt of concs)	9 700 000	10 300 000	10 600 000	11 900 000	12 400 000
Rutile (wt of concs)	414 000	415 000	434 000	570 000	638 000
All forms (TiO_2 content)	*5 000 000	*5 200 000	*5 500 000	*6 300 000	*6 600 000

Note(s):-
(1) The figures in this table refer to gross tonnage of titanium concentrates
(2) Some ilmenite is converted to synthetic rutile in Australia, India, Japan, Taiwan and USA

(a) Canada produces some ilmenite which is sold as such and not processed into slag, but tonnages are small
(b) It is believed that the majority of this is processed into slag. In 2007 South Africa produced an estimated 1 110 000 tonnes of slag (85% TiO_2) and Canada produced an estimated 1 010 000 tonnes of slag (80-95% TiO_2)
(c) BGS estimates, based on known imports into certain countries
(d) Years ended 31 March following that stated

Mine production of tungsten

tonnes (metal content)

Country	2003	2004	2005	2006	2007
Austria	1 381	1 335	1 280	1 153	1 117
Portugal (c)	715	746	816	780	846
Russia (c)	*3 900	*3 000	*4 400	*4 000	*4 400
Burundi	13	8	94	238	163
Congo, Democratic Republic	*120	*20	*180	*500	*500
Rwanda	95	125	442	1 139	2 130
Uganda	2	63	36	75	*75
Canada	3 654	—	484	2 561	2 700
Bolivia	441	403	530	870	1 106
Brazil (a)	30	293	557	525	537
Burma (b)	93	106	166	193	200
China	36 185	59 947	51 200	45 000	*41 000
Kazakhstan	...	...	...	50	100
Korea, Dem. P.R. of	*600	*600	*600	*600	*600
Kyrgyzstan	*100	*100	*100	*100	*100
Mongolia	12	48	54	58	116
Thailand (c)	390	337	622	546	823
Uzbekistan	*300	*300	*300	*300	*300
Australia	—	...	(d) (e) 44	(d) (e) 13	(d) (e) 30
World Total	48 000	67 400	61 900	58 700	56 800

Note(s):-
(a) Mainly scheelite
(b) Including tungsten content of tin-wolframite concentrates
(c) Wolframite and scheelite
(d) Scheelite
(e) Years ended 30 June of that stated

URANIUM

Characteristics

Uranium is a very dense, metallic element which is naturally radioactive. It spontaneously decays, through a long series of alpha or beta particle emissions, ultimately forming the stable element lead.

It occurs in a variety of different geological environments. The largest economic deposits are in sedimentary rocks, but deposits are also found in hydrothermal, metamorphic, surficial and igneous settings. Under oxidising conditions it exists in a highly soluble form and is therefore very mobile. However, under reducing conditions, where oxygen is depleted, it converts to an insoluble form and is precipitated. This is the process that usually results in concentrations of uranium that are sufficient for economic extraction. The most common uranium mineral is uraninite (uranium oxide), known as pitchblende when in its massive form. Lesser amounts of the silicate brannerite and the uranium titanate, coffinite, also occur in economic deposits, in association with uraninite. The product shipped from all uranium mines is purified solid U_3O_8, known as 'yellowcake'. This is produced by leaching either crushed or in situ ore, followed by solvent extraction, precipitation, and calcining.

Uranium occurs as several isotopes, of which the most abundant are uranium-238 (about 99.3 per cent of natural uranium) and uranium-235 (0.7 per cent of natural uranium). In most nuclear power plants it is uranium-235 that is required and hence uranium often undergoes enrichment prior to being made into fuel.

Uses

Uranium's main use comes from the energy that is released when an atom of uranium is split by nuclear fission. This is caused by the uranium atom being struck by, and absorbing, an extra neutron. Each time an atom undergoes fission, additional neutrons are also released and these can cause a chain reaction to occur if they collide with other uranium atoms.

Over 95 per cent of uranium is used in the production of electricity in nuclear power stations. The remainder is used for the propulsion of ships, research, desalination and military ordnance.

Most nuclear power stations use the fission of uranium-235 as a heat source for converting water into steam. The steam is then used to propel turbines, which generate electricity, in the same way that fossil fuels are used in conventional power stations. The main contrast is that one kilogram of uranium-235 produces approximately three million times more energy than a similar weight of coal.

The International Energy Agency (IEA) estimates that 18 930 TWh of electricity were produced around the world in 2006. Of this, 14.8 per cent was produced by nuclear power, compared to 41.0 per cent produced by coal (IEA, 2008). However, some countries are far more reliant on nuclear power to generate their electricity than this overall figure would suggest. For example, in 2006, France produced 79.1 per cent of its electricity requirements from nuclear power, compared to 19.1 per cent in the UK. In China, the figure was only two per cent, but significant growth in nuclear power is anticipated due to the number of new reactors under construction or planned.

In December 2008, there were a total of 439 nuclear reactors generating electricity in the world, with another 39 under construction. This includes nine in China, eight in Russia and six in India. A further 106 reactors were 'on order or planned', including 24 in China, and 270 reactors were 'proposed' of which 76 were in China (World Nuclear Association, 2008).

In addition to nuclear reactors for electricity production, there are currently around 280 reactors used for research purposes in 56 countries. These are used to create neutron beams suitable for studying the structure and dynamics of materials at atomic level. They are also used to produce radioisotopes for medical applications such as cancer treatment.

Nuclear reactors have also been used to propel ships since the 1950s. They are particularly useful in submarines and ships operating in arctic conditions where they provide considerably more power than other fuels, and enable long periods at sea without the need to refuel. Eleven of the USA's aircraft carriers are also propelled in this way.

Desalination is an energy intensive process and in this context nuclear power is often cost-competitive with other sources of power. In several countries desalination takes place alongside electricity generation and there is potential for this combined method to increase.

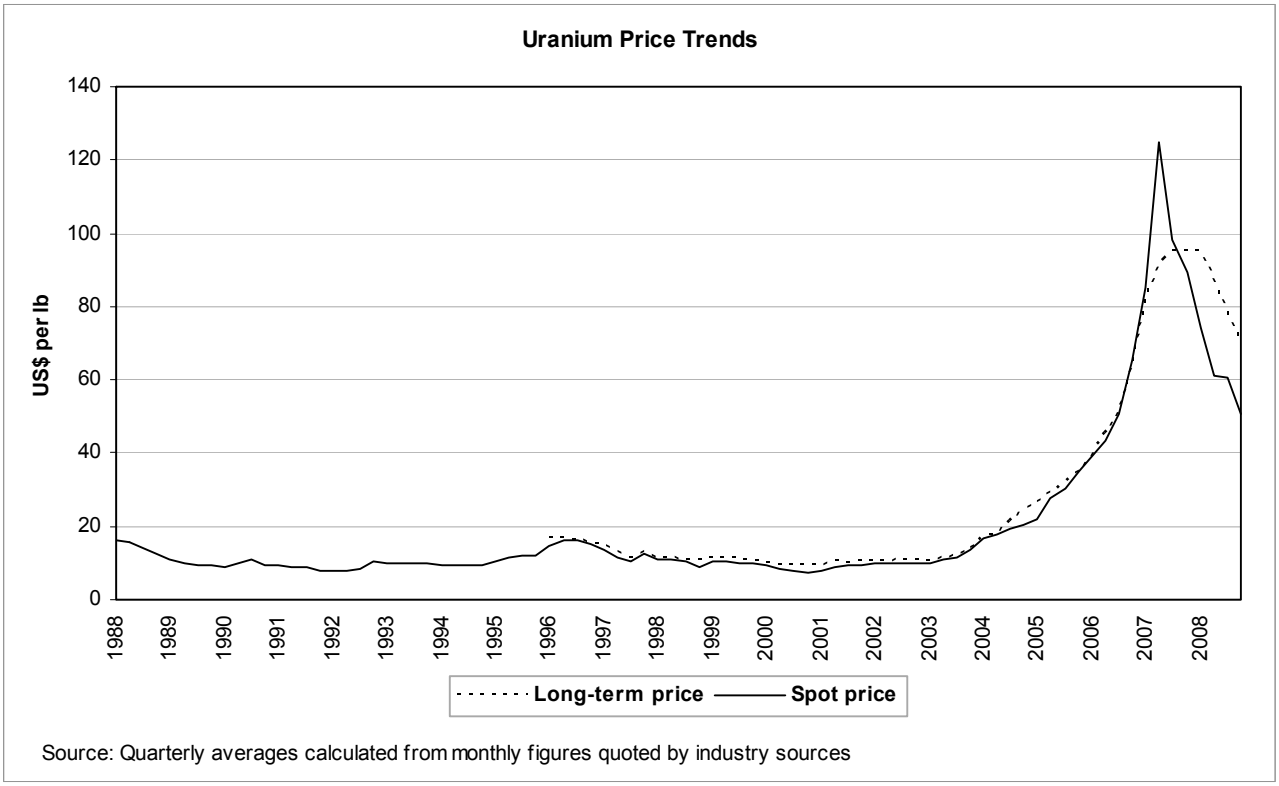
Uranium has long been a sensitive political topic because highly enriched uranium (which contains over 90 per cent of uranium-235) can be used in weapons. No uranium used in power stations is capable of use in a weapon because it contains either natural or low-enriched uranium (generally a maximum of 5 per cent of uranium-235). However, low-enriched uranium can be converted into highly enriched uranium with further enrichment.

To prevent the spread of nuclear weapons, the International Atomic Energy Authority (IAEA) has operated a series of safeguards since 1970 under the Nuclear Non-proliferation Treaty. A large number of nations have signed the Treaty, including the five countries who have officially declared that they have nuclear weapons: USA, Russia, China, UK and France. Three other countries are known to hold them: India, Pakistan and Israel, but these countries have not signed the Treaty. North Korea withdrew from the Treaty in 2003 and claimed to have tested a nuclear weapon in 2006. Subsequent negotiations resulted in the closure of their nuclear facilities in 2007. Another country causing concern is Iran. It is a signatory of the Treaty and insists that the construction of facilities in the country is for peaceful purposes. The work of the IAEA in attempting to enforce safeguards under the Treaty is often difficult and politically sensitive.

World Production in 2007

The total mined production of uranium (metal content) rose in 2007 compared to 2006, reversing the decline from the previous year. This was largely as a result of significant increases in production in Kazakhstan and Australia, which more than off set a reduction in output from Canada.

Canada continued to be the largest producer of mined uranium, with 23 per cent of the world's total, down from 25 per cent the previous year. Production levels have fallen from more than 11 000 tonnes in 2005 to just 9500 tonnes in 2007. Australia was in second place, with 21 per cent of the world total, following an increase in production to 8600 tonnes. Kazakhstan remained in third place, with 16 per



Source: Quarterly averages calculated from monthly figures quoted by industry sources

cent of the world total, and continued its steady increase in production to more than 6600 tonnes. Since 2003, production in Kazakhstan increased by 101 per cent.

Other significant producing countries include Russia, Niger, Namibia, Uzbekistan and USA. Russia's production levels increased in 2007 compared to 2006 and they moved ahead of Niger whose production fell. As expected, Namibia's production rose in 2007 compared to 2006 following the opening of a new mine. Production in the USA continued its upward trend, which has seen output increase by 126 per cent in five years. However this is still far short of the historical production levels from the 1970s. Uzbekistan saw a slight rise in production in 2007, but output was still lower than that achieved in 2005.

Prices

Over 80 per cent of uranium is sold under long-term contracts (three to seven year terms), however, a spot market has been in existence for several years and this is frequently referred to when negotiating prices for long-term contracts. From 1988 to 2004 spot market prices were very low, rising to a mere US$20 per pound by the end of 2004. Since then, however, they have risen sharply reaching a height of US$138 per pound in June 2007. This was followed by an equally sharp fall in the latter part of 2007, reaching a low of US$53 per pound during 2008. At the end of the year the spot price was around US$55 per pound.

The long-term industry average price rose more slowly, but still significantly, from a low of just over US$9 per pound in 2000 to around US$95.00 at the end of 2007 before falling back to US$75 per pound during 2008.

Demand for uranium, for electricity generation, continues to be much higher than current mine production levels, with the shortfall being supplied by reprocessing, stockpiles or the conversion of weapons-grade uranium into fuel for power stations. Concerns over continuity of supply resulted in the increase in prices during the first part of 2007. This was due in part to an increase in the number of nuclear reactors proposed or planned as a result of current international efforts to reduce carbon dioxide emissions. However, part of the increase during 2007 was probably caused by speculation in the market. Once market speculators withdrew their interest and the concerns over security of supply in the near-term were relaxed, the price fell. However, there are no signs that the demand for nuclear energy is weakening and the requirement for uranium to supply power stations remains higher than current mining production levels.

Industry events in 2008

News events in Australia were virtually all positive for uranium mining in 2008. In particular the election of a new state government in Western Australia has seen the lifting of the long-running ban on uranium mining in the state (Mining News, 2008a; Lovesey, 2008a). Several dormant deposits may now be progressed including BHP Billiton's Yeelirrie project (Jacoby, 2008a), Mega Uranium's Lake Maitland project (Mining Journal, 2008a) and Toro Energy's Wiluna project (Dixon, 2008a).

Elsewhere, expansion has been approved at Beverley uranium mine in South Australia (Dudley, 2008a; Mineweb, 2008a) and Honeymoon is making progress towards becoming Australia's fourth uranium mine in 2009 or 2010 (Jacoby, 2008b; Mining Journal, 2008b). The deposits at Four Mile, also in South Australia, may beat them to it however by commissioning in early 2010 (Mining News, 2008b; Louthean, 2008a) and another prospect at Crocker Well is targeting production for later that year (Louthean, 2008b).

The news from Canada was much more mixed during the year with more water inflow problems experienced at Cigar Lake delaying production to at least 2011 (Kosich, 2008a) and news of uranium bans in British Columbia (Kosich, 2008b) and Labrador Inuit Lands (Kosich, 2008c). However, Cameco did

report that the water problems at Eagle Point have been resolved and mining has resumed (Kosich, 2008d).

Uranium mining developments continue to be positive in Namibia in 2008 with expansions for both operating mines at Rössing (Mineweb, 2008b; Lovesey, 2008b) and Langer Heinrich, with the latter ramping up to its specified capacity (Dudley, 2008b). The first shipment from the country's third mine, Trekkopje, is expected in the first quarter of 2009 (Mukumbira, 2008a). Exploration continues to discover additional high grade prospects, including at Rössing South/Husab (Jacoby, 2008c) and over the next four to five years Namibia expects to have up to six operating uranium mines (Murray, 2008).

Production is also expected in early 2009 at a new uranium mine at Kayelekera in Malawi (Jomo, 2008a), a development which is expected to boost that country's GDP by as much as 10 per cent (Jomo, 2008b).

Exploration continues in many parts of Africa with reports of mineralisation from Tanzania, Zambia and Botswana as well as Namibia and Malawi. In Tanzania, Western Metals reported a new type of uranium mineralisation in basement rocks which may lead to further discoveries in areas that have been overlooked in the past (Lawson, 2008). Zambia has received approval from the International Atomic Energy Agency for the legal framework in place for licensing of uranium mining (Mukumbira, 2008b).

However, uranium mining in Africa is not without its problems – as evidenced by the experiences of Areva in Niger and Uranium One in South Africa. In Niger four Areva employees from the Cominak Mine were kidnapped in June by Tuareg-led rebels (Massalatchi, 2008). Fortunately they were quickly released but threats of further attacks remain (Mukumbira, 2008c). Despite this Areva continues to operate both working mines in Niger and plans to commission a third at Imouraren by 2010/11 (Foulkes and Litvin, 2008). Other foreign companies, particularly the Chinese, are also exploring in Niger and a fourth mine is under development at Teguidda.

In South Africa the Dominion Mine was put onto care and maintenance in October after much speculation in the press about the mine's under-performance and the size of losses incurred by Uranium One (Kruger, 2008a; Sergeant, 2008a). With a new Chief Executive Officer in place, the company now intends to concentrate on its three producing mines in Kazakhstan (Sergeant, 2008b).

Elsewhere in the world, the current zero-tolerance view on uranium production in Greenland may shortly be eased after the Country's parliament approved in principle the by-product production of uranium from the Kvanefjeld project (Batten, 2008). Uranium by-production is also expected to commence shortly at the Ezulwini gold mine in South Africa (Kruger, 2008b). Russia and Kazakhstan are both expecting to increase uranium output in 2009 in response to surging demand for nuclear power from Asia (Faulconbridge and Paxton, 2008). Exploration results have also been reported during the year in Spain, Sweden, Jordon and Argentina.

The commercial possibility of extracting uranium from coal waste is being tested in China where Sparton Resources estimate they can recover an average of 0.46 lb U_3O_8 per tonne of waste from three thermal coal-fired power stations. Early results are described as 'very positive' and similar test work is planned in other countries (Dixon, 2008b).

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Mine production of uranium

tonnes (metal content)

Country	2003	2004	2005	2006	2007
Czech Republic	458	435	420	383	322
Germany	104	77	80	65	41
Romania	90	90	*90	*90	*77
Russia	3 150	3 280	3 431	3 262	3 413
Ukraine	*800	*800	*800	*800	846
Namibia	2 416	3 159	2 855	2 782	2 879
Niger	3 143	3 273	3 093	3 431	3 154
South Africa	758	752	674	542	525
Canada	10 456	11 599	11 627	9 862	9 500
USA	*770	878	1 034	1 579	1 744
Brazil	310	300	110	190	299
China	*750	*750	*750	*750	*712
India	*230	*230	*230	*177	*270
Kazakhstan	3 300	3 719	4 357	5 279	6 637
Pakistan	*45	*45	*45	*45	*45
Uzbekistan	1 770	2 035	2 629	2 270	2 320
Australia	7 633	9 010	9 516	7 606	8 603
World Total	36 200	40 400	41 700	39 100	41 400
World Total (U_3O_8 equivalent)	42 700	47 700	49 200	46 100	48 800

Note(s):-
(1) Excluding uranium production from decommissioning operations in France, Germany and Spain

Mine production of vanadium

tonnes (metal content)

Country	2003	2004	2005	2006	2007
Russia	18 099	24 277	*24 000	*24 000	*25 000
South Africa	27 172	23 303	22 604	23 800	*24 000
China	*14 000	*16 000	*17 000	*17 500	*18 500
Kazakhstan	*1 000	*1 000	*1 000	*1 000	*1 000
Australia	694	220	—	—	—
World Total	61 000	65 000	65 000	66 000	69 000

Note(s):-
(1) This table includes vanadium in slag products but excludes vanadium recovered as a by-product of the refining and burning of heavy oils

Production of vermiculite

tonnes

Country	2003	2004	2005	2006	2007
Russia	*40 000	*30 000	*30 000	*30 000	*30 000
Egypt (c)	*400	*400	6 655	*6 600	*6 600
South Africa	182 802	196 893	209 801	197 765	199 664
Uganda	1 724	2 688	2 574	3 512	*3 500
Zimbabwe	13 260	27 150	23 045	13 421	*13 000
USA (a)	*110 000	*100 000	*100 000	*100 000	*100 000
Argentina	1 124	1 293	1 403	1 585	*1 600
Brazil	26 000	26 000	24 191	19 279	18 952
China	*90 000	*100 000	*100 000	*110 000	*110 000
India (b)	4 493	3 377	6 674	10 374	13 846
Japan	*6 200	*6 000	*6 000	*6 000	*6 000
Australia (c)	13 436	9 676	8 769	9 392	8 900

Note(s):-
(1) In addition to the countries listed Malawi is believed to produce vermiculite

(a) Sold or used by producers
(b) Years ended 31 March following that stated
(c) Years ended 30 June of that stated

Production of wollastonite

tonnes

Country	2003	2004	2005	2006	2007
Finland	17 300	16 763	15 950	16 200	16 364
Spain	...	...	30 000	30 000	30 000
Namibia	585	406	253	55	*60
Mexico	31 234	28 224	27 132	44 280	50 809
USA	*120 000	*120 000	*120 000	*125 000	*125 000
China	340 000	345 000	350 000	350 000	*350 000
India (a)	150 814	170 292	128 582	131 572	118 666

Note(s):-
(1) In addition to the countries listed, Turkey is believed to produce wollastonite

(a) Years ended 31 March following that stated

ZINC

Characteristics

Zinc is the 23rd most abundant element in the Earth's crust. Zinc is a blue-grey metal; the freshly cut surface having a typical metallic lustre, which quickly tarnishes to dull grey when exposed to air, due to oxidation. It is moderately reactive and burns with a bright bluish-green flame in air. It reacts with both acids and alkalis. Malleable between 100°C to 210°C, above 210°C zinc becomes brittle and can be powdered. Zinc is non-magnetic.

Zinc does not occur in nature in the form of native (free) metal. The most commonly found ore minerals are sphalerite (zinc sulphide, ZnS), also known as zinc blende, and its variety marmatite (zinc sulphide containing some iron sulphide, ((Zn,Fe)S), from which over 95 per cent of the world's zinc is produced). Other economically important zinc minerals include smithsonite or zincspar ($ZnCO_3$), willemite (Zn_2SiO_4) and hemimorphite ($Zn_4Si_2O_7(OH).2H_2O$), which may occur in the near-surface weathered or oxidised zone of an ore body. Less important are metamorphically formed zinc oxide ores such as the spinel, franklinite (Zn, Fe, Mn)((Fe, $Mn)_2O_4$) or zincite (ZnO).

Zinc deposits are formed by deposition from hydrothermal brines and are generally polymetallic, commonly including economic levels of copper, lead, silver, cadmium, bismuth, tin and gold. Economic levels of barite and fluorite may also be present. Zinc ore deposits are widely spread throughout the world and mining is currently carried out in more than 50 countries. China, Australia, Peru, USA, Kazakhstan, Mexico and Canada, have the largest zinc reserves (USGS, 2008).

Before the zinc can be recovered from ore concentrate, the sulphur content must be removed by sintering. The concentrate is brought to a temperature of more than 900°C converting the sulphide into the more active zinc oxide and sulphur is driven off as sulphur dioxide gas which subsequently is converted to sulphuric acid, an important commercial by-product. The zinc can then be extracted from the calcine either by leaching and subsequent electrolysis or by smelting in a blast furnace. Today, over 90 per cent of zinc is produced in electrolytic plants. Smelting is extremely energy intensive but has the advantage that it allows simultaneous production of lead, commonly associated with zinc in ore bodies. Electrolytic recovery produces more than 99.9 per cent pure zinc, which requires no subsequent refining (American Zinc Association, 2008).

Total world reserves of zinc are 180 million tonnes of which Australia holds 42 million tonnes, China 33 million tonnes and Peru 18 million tonnes (USGS). At present, approximately 70 per cent of the zinc produced worldwide is primary and 30 per cent is from recycled or secondary (including manufacturing scrap) sources. The level of recycling is increasing and over 80 per cent of the zinc available for recycling is recycled (International Zinc Association, 2008).

Uses

Current global uses of refined zinc (ILZSG, 2008):

- galvanizing (50 per cent)
- brass and bronze (17 per cent)
- zinc alloys (for die-casting industry etc.) (17 per cent)
- chemicals (6 per cent)
- semi-manufactures (6 per cent)
- miscellaneous (4 per cent)

From these first-use manufactures zinc is transformed into in a broad range of products. The main application areas are in construction (45 per cent), transport (25 per cent), consumer goods and electrical appliances (23 per cent), and general engineering (7 per cent). Zinc's ability to protect iron from corrosion in galvanising determines its most important use, and most of this product goes to supply the construction industry. Overall, about 75 per cent of zinc used is used as metal. The remainder is used in zinc compounds mainly by the rubber, chemical, paint, and agricultural industries (International Zinc Association, 2008).

World production in 2007

World mine production of zinc was 11 million tonnes (metal content) in 2007, a six per cent increase on 2006. More than 40 countries mine zinc and the top three of these produce more than one million tonnes each (China, Australia and Peru). China was the top mine-producer of zinc and in 2007 mined almost three million tonnes, a four per cent increase on 2006 figures. Peruvian production made a notable increase of 20 per cent (on 2006) to 1.4 million tonnes in 2007.

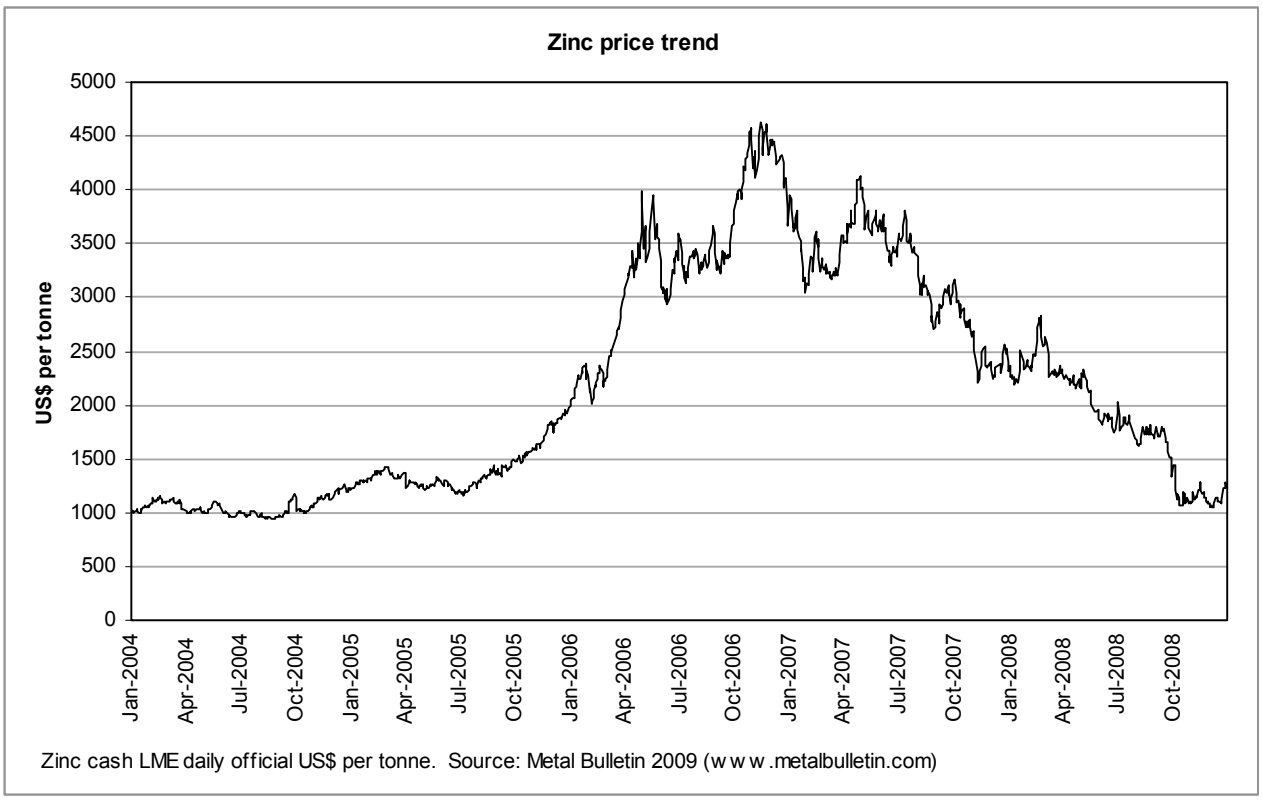
World slab zinc production in 2007 was 11.3 million tonnes. This was also a six per cent increase on 2006. Production increased steadily during the period 2003 to 2007, showing an overall increase of 14 per cent, although with a slight dip (two per cent) from 2004 to 2005. China remained the top-producing country with 3.7 million tonnes in 2007. This represents an 18 per cent increase on 2006 and a 60 per cent increase since 2003. Canada was the second-largest producer with 0.80 million tonnes and the Republic of Korea third, with production of 0.69 million tonnes in 2007.

Prices

Prices have more than halved over the course 2008. Dropping from around US$2500 per tonne in January 2008 to around US$1100 per tonne by the end of the year, almost four times less than the highest price in 2007. The prices peaked in March 2008 at around $2800 per tonne, before dropping fairly steadily as the zinc surplus rose. The zinc price experienced its largest month on month drop of the year during October, when it fell around $500 (Metal Bulletin, 2008a).

The drop was not dissimilar from that initially estimated by ABARE at the beginning of the year (45 per cent) when, as predicted new projects came online late 2007 and the surplus of zinc rose. CRU International predicted that zinc supplies are expected to exceed demand over the next three years, resulting in an accelerating price decline. Natixis expected a 1.9 per cent drop in demand from the automotive and steel industries. The International Lead and Zinc Study Group (ILZSG) predicted a 9.5 per cent increase in zinc production over 2008, resulting in a surplus of stocks and driving zinc price down. They expected Zinc supply to exceed usage by 150 000 tonnes in 2008 (Mining Journal, 2008a). In August, zinc stockpiles were at their highest in more than six months and European zinc producers shipped zinc to Dubai or USA in order to try and protect European premiums (Metal Bulletin, 2008b). However the rising inventories and corresponding price drop in response to slow demand forced more mine closures throughout the second half of the year, which took increasingly higher tonnages out of the market.

High zinc prices in 2007 resulted in smelters pushing for higher treatment charges early in the year, initially asking for



Zinc cash LME daily official US$ per tonne. Source: Metal Bulletin 2009 (www.metalbulletin.com)

$375 based on an LME price of $2500 per tonne. Although, falling zinc premiums lead to protracted negotiations, treatment charges were settled on average around $350, about 30 per cent higher than in 2007 (Metal Bulletin, 2008c).

Severe storms in China in early 2008 cause closure of several mines and in May the earthquake in Sichuan province forced mines and smelters to close and caused the three month zinc price to rise seven per cent. This coincided with strikes at Nambian Scorpion zinc mine, putting supply into uncertainty (The Northern Miner, 2008). In June it was reported that the increase in Chinese imports was due to zinc being used for financing, rather than for domestic consumption (Metal Bulletin, 2008d). By October, imports had dropped 66 per cent from the September levels and the Chinese turned to copper for finance buying.

Industry events in 2008

Throughout 2008, falling zinc prices and increased operational costs took its toll on new projects, established mines and smelters alike. Several mergers were attempted: Zinifex and Oxiana Ltd officially merged on 1st July, to form Oz Minerals, making it the 2nd largest zinc producer behind Xstrata. However the new company struggled through the second half of the year, reducing outputs at various mines (including Golden Grove and Century), pulling out of joint ventures (with Drake and Legend) and closing the Dugald River Project, which had been due to start next year. By year end they were under review and entered voluntary suspension, after being unable to refinance their debt, citing exchange rates, low commodity prices and the tight credit market (Mining News, 2008a).

CBH Resources and Perilya both with operations in Broken Hill Australia entered merger discussions in March, which would have made them the 9th largest zinc producer. However falling zinc prices caused Perilya to end the negotiations in June. In December, Perilya entered discussions with Chinese producer, Shenzhen Zhongiin Lingan Nonfemet. Meanwhile, Perilya cut their Broken Hill operations by 50 per cent in August in order to keep the mine life at three years, but upgraded their resources in November, extending mine life a further six years. CBH Resources increased capacity at its Endeavour Mine during the 2nd quarter, due to higher grades and mill expansion, despite shedding one third of it workforce in June. However dropping zinc prices caused them to reduce production by a third in November (Mining News, 2008b).

HudBay launched a takeover bid of Lundin Mining, however this was opposed by HudBay's shareholder Jaguar Financial Corp, who launched a counter-takeover bid for HudBay (Mining Journal, 2008b). By the end of 2008, the outcome had not yet been reached. Lundin suspended production from Neves Corvo Mine in Portugal and sold their Ajustrel Mine in December after putting it on care and maintenance.

In April, Hindustan Zinc became largest integrated lead–zinc producer, by expanding production capacity at two mines, starting a new mine and the announcement of two new smelter projects expected to be complete in 2010. The new zinc smelter at Chanderiya, west India was due to come online in March 2008, but actually started four months early in December 2007.

In China's central Hunan province, snow storms early in the year resulted in power outages, which caused smelters to shut temporarily. The Zhuzhou Smelter Group's smelter restarted in early February (Metal Bulletin, 2008e). Then, in May the earthquake in Sichuan province and subsequent aftershocks halted production at smelters and suspended mining in both Sichuan province and in the neighbouring Gansu province (which produces 20 per cent of China's zinc).

Also in May, workers went on strike at Anglo American's Scorpion zinc mine (the world's 8th largest) in Namibia over pay. In October 675 workers went on strike at Xstrata's Kidd Creek copper–zinc metallurgical plant in Canada.

Mine and project closures began in July with AIM resources suspending their Perkoa project in Burkina Faso, (despite efforts to increase its feasibility by recovering silver as a by-product) and Teck (formerly Teck Cominco prior to October 2008), closing its Lennard Shelf Mine two years earlier than originally planned (Mining Journal, 2008c). In December, Teck also shut its Pend Oreille zinc mine, in Washington and laid off 165 employees citing the 'reduced metal demand and the persistent weakness in zinc prices'. In September both Intec's Helleyer Mine in Tasmania and the Whyalla smelter in South Australia closed, the latter after only three months in operation.

By December the low zinc prices also forced Glencore to suspend its three Tennessee operations and its Rosaura zinc mine in Peru. Xstrata also reduced production at its McArthur River zinc mine by 20 per cent and shed 40 per cent of its workers. Plans to expand the mine which would extend the mine life by 25 years were blocked by a Federal Court decision (Mining News, 2008c).

Terramin Australia made their first shipment of zinc concentrate from their Angas Mine, near Adelaide in September from which Terramin plans to produce 400 000 tonnes of zinc and lead–copper–gold–silver concentrates over seven years. They reported that their second shipment, in November cost them even less, due to favourable exchange rates and a drop in smelter charges (Mining News, 2008d).

Low zinc prices, increased production costs and falling demand, particularly from the steel industry forced cuts and closures at European smelters. Nystars smelters fell 28 per cent in November, culminating in the suspension of operations at Balen (255 000 tonnes per year capacity) with further cuts reported likely in 2009. In December, Ruhr Zinc closed its 140 000 tonnes per year smelter in Germany. Boliden's Finnish and Norweigan smelters plan to cut production by 60 000 tonnes per year. In the Far East smelters have also cut back, notably Korea Zinc (world's 2nd largest zinc smelter) plans to reduce output by 10 per cent for more than a year and China's Zijin Mining Group by 30 per cent due to slowing domestic demand in China. The Russian zinc smelter Chelyabinsk Zinc posted a loss in the first nine months of the year, due to a 39 per cent drop in zinc prices over that period and after their exploration project in the Ural Mountains turned out to be uneconomic. Huludao Zinc, China's second largest smelter closed 27 per cent of its annual production of zinc in December (Mining Journal, 2008d).

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Mine production of zinc

tonnes (metal content)

Country	2003	2004	2005	2006	2007
Armenia	2 065	1 927	3 196	2 270	2 560
Bosnia & Herzegovina	300	1 100	2 500	902	4 485
Bulgaria	13 000	*12 700	*12 000	*10 400	*11 500
Finland	38 800	37 200	40 500	35 700	38 900
Greece	3 000	—	4 000	18 000	21 300
Ireland, Republic of	419 000	438 300	445 400	425 800	400 900
Macedonia	—	—	—	9 349	32 195
Poland	154 277	140 381	135 600	126 600	129 600
Portugal	—	—	—	7 505	24 163
Romania	22 081	23 599	13 784	8 052	849
Russia	159 000	161 700	186 000	178 000	177 000
Serbia	—	—	—	2 100	1 200
Serbia and Montenegro	2 200	1 300	900	—	—
Spain	15 140	—	—	—	—
Sweden	185 884	197 034	215 691	210 029	214 576
Turkey	40 000	39 000	56 000	59 000	71 000
Algeria	1 450	116	2 206	303	—
Congo, Democratic Republic	5 900	6 000	5 700	20 784	13 800
Morocco	68 912	70 600	77 300	74 400	55 100
Namibia	105 452	185 228	202 168	185 355	206 000
South Africa	41 239	32 001	32 112	34 444	31 062
Tunisia	36 200	29 011	15 713	3 000	—
Canada	788 063	791 373	666 664	637 956	622 945
Honduras	43 766	41 413	42 698	37 646	29 211
Mexico	413 991	426 360	476 307	479 400	452 012
USA	767 600	738 900	747 900	727 100	803 300
Argentina	29 839	27 220	30 227	29 808	27 000
Bolivia	145 490	147 430	159 502	172 747	214 053
Brazil	152 822	158 962	170 659	185 211	193 899
Chile	33 051	27 635	28 841	36 238	36 453
Peru	1 372 790	1 209 006	1 201 671	1 203 364	1 444 354
Burma	*2 000	*5 000	*12 000	*8 000	*12 000
China	2 029 100	2 391 200	2 547 800	2 844 200	2 950 000
India (a)	318 300	354 600	472 241	503 395	558 200
Iran	111 000	127 000	156 000	166 000	75 000
Japan	47 800	47 800	41 500	7 200	—
Kazakhstan	393 200	361 400	364 300	404 600	386 000
Korea, Dem. P.R. of	*52 000	*62 000	*65 000	*85 000	*110 000
Korea, Republic of	—	14	77	16	2 034
Laos	1 200	1 000	1 500	4 000	3 000
Mongolia	—	—	11 400	54 950	77 350
Philippines	—	—	2 000	3 000	7 400
Saudi Arabia	900	1 000	1 000	983	*1 000
Thailand	22 245	29 922	30 572	32 103	26 406
Vietnam	50 000	40 000	48 000	45 000	45 000
Australia	1 479 000	1 334 000	1 367 000	1 362 000	1 514 000
World Total	9 600 000	9 700 000	10 100 000	10 400 000	11 000 000

Note(s):-
(a) Years ended 31 March following that stated

Production of slab zinc

tonnes

Country	2003	2004	2005	2006	2007
Belgium	244 400	272 500	222 000	251 000	240 000
Bulgaria	86 800	101 500	92 500	85 900	93 200
Finland	265 853	284 525	281 904	282 238	305 543
France	257 000	260 000	209 000	120 000	116 000
Germany	388 131	382 020	334 900	342 566	334 891
Italy	123 100	118 400	121 200	109 200	102 100
Macedonia	23 746	—	—	—	—
Netherlands	224 000	224 000	227 500	227 500	225 000
Norway	143 627	140 901	151 285	160 670	157 027
Poland	154 200	155 500	137 300	133 900	141 900
Romania	51 000	52 746	56 795	43 705	58 342
Russia	253 000	239 000	211 000	248 000	263 000
Serbia	—	—	—	15 000	2 000
Serbia and Montenegro	62	3 664	18 000	—	—
Spain	519 000	525 000	501 400	507 300	494 100
United Kingdom	16 600	—	—	—	—
Algeria	34 928	33 414	36 699	32 854	27 249
Namibia	47 436	120 533	132 818	129 897	150 100
South Africa	112 000	105 000	104 000	90 000	10 100
Zambia	2 000	2 000	—	—	1 000
Canada	761 199	805 438	724 035	824 465	802 103
Mexico	320 364	316 834	327 205	279 734	321 932
USA	302 600	306 000	309 000	268 900	277 010
Argentina	42 360	38 298	40 457	45 991	47 400
Brazil	270 000	273 000	274 000	279 000	272 000
Peru	202 076	195 692	163 603	175 250	162 575
China	2 318 500	2 719 500	2 776 100	3 153 000	3 714 000
India	280 000	272 000	302 000	415 000	459 000
Iran (a)	78 428	109 400	140 000	139 000	*126 000
Japan	651 246	634 637	638 352	614 331	597 650
Kazakhstan	294 965	316 700	338 000	364 821	358 226
Korea, Dem. P.R. of	*55 000	*65 000	*57 000	*51 000	*40 000
Korea, Republic of	644 218	669 171	646 817	667 000	691 000
Thailand	113 700	115 500	104 500	94 779	99 337
Uzbekistan	58 100	*58 000	42 000	46 000	71 800
Vietnam	—	—	*7 000	*10 000	*10 000
Australia	553 000	473 000	457 000	464 000	502 000
World Total	9 900 000	10 400 000	10 200 000	10 700 000	11 300 000

Note(s):-
(a) Years ended 20 March following that stated

Production of zirconium minerals

tonnes

Country	2003	2004	2005	2006	2007
Russia (a)	*6 600	*5 500	*6 700	*7 500	7 136
Ukraine	*35 000	*35 000	*35 000	*35 000	*35 000
Gambia	12 500	*12 000	*12 000	410	...
South Africa	*370 000	379 000	314 000	414 400	388 800
USA	144 000	172 000	164 000	143 000	120 000
Brazil (a)	27 198	25 263	25 657	25 120	26 739
China	*50 000	*140 000	*160 000	*170 000	*180 000
India	25 263	25 432	27 133	*22 000	*24 000
Indonesia	*250	*500	*2 600	*65 000	*111 000
Malaysia	3 456	6 686	4 954	1 690	7 393
Sri Lanka	—	12 826	23 587	8 321	381
Thailand	—	—	—	—	1 023
Vietnam (b)	*21 300	*40 000	*35 000	*27 000	*22 000
Australia	462 000	441 000	426 000	491 000	600 000
World Total	1 158 000	1 295 000	1 237 000	1 410 000	1 524 000

Note(s):-
(1) In this table the term 'zirconium minerals' is understood to mean zircon, unless otherwise stated

(a) Including caldasite rock containing zircon and baddeleyite
(b) Conservative BGS estimates, based on exports

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