World Mineral Production

2005–2009

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

BRITISH GEOLOGICAL SURVEY

WORLD MINERAL PRODUCTION 2005–09

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Cover photograph: Part of the processing plant at Rössing Uranium Mine, Namibia. Picture: T J Brown.
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PREFACE

This volume is the latest in the series *World Mineral Production*, published by the British Geological Survey. It comprises the most recent addition to a continuous dataset on global mineral production which stretches back to 1913, which includes the preceding titles *World Mineral Statistics* and *Statistical Summary of the Minerals Industry*.

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 2005 to 2009. We have also included reviews on selected minerals and metals, which provide information on uses, prices, recent production trends and industry events. The objective of this series remains to present the latest 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.

The global recession that continued during the first part of 2009 clearly had an impact on the worldwide production of many minerals and this is reflected in the statistics reported in this volume. For example, global production of potash and lithium minerals fell by more than 30 per cent compared to 2008 while output of diamonds, barytes and kaolin dropped by approximately one quarter. However, this trend was not universal and other minerals were produced in greater quantities in 2009. In particular the worldwide production of uranium increased by 15 per cent compared to the previous year, predominantly due to a 63 per cent increase in output from Kazakhstan which made it the largest producing country in the world for the first time in 2009.

Although there are still concerns surrounding certain national economies, the beginning of a global recovery is reflected in increasing demand for certain key minerals and metals. This is demonstrated by rising prices, particularly for the rare earth elements and metals such as gold and palladium, but also in a less dramatic way for aluminium, nickel and zinc. It is likely that the emerging economies, especially China and India, are the main drivers of this increased demand. Prices are also driven higher by continuing concerns over the long-term security of supply for particular commodities.

Following on from the publication of the *Raw Materials Initiative* by the European Commission (EC), the EC Working Group on defining critical raw materials published its findings in *Critical Raw Materials for the European Union*, released in June 2010. This report identifies 14 minerals and metals which are classed as 'critical', i.e. they have a high supply risk and are of high economic importance to the member countries of the European Union. These are: antimony, beryllium, cobalt, fluorspar, gallium, germanium, graphite, indium, magnesium, niobium, platinum group metals, rare earths, tantalum and tungsten. Statistics relating to the production of most of these critical minerals are provided in this volume and an in-depth analysis of several of them can be found in the BGS' *Mineral Profile* series. BGS continues to work with European colleagues to provide the information and analysis necessary to inform the development of policy in this area.

Security of supply concerns over the past year have also led the UK Government to investigate this issue. The Department for Environment, Food and Rural Affairs has reviewed future resource risks faced by UK business, whilst the Department for Transport commissioned a study on the supply of lanthanides (one of the rare earth elements) required for the manufacture of electric vehicles.

In addition to our regular publications, we are continuing to add to our *Mineral Profile* series with the addition of *Rare Earth Elements*, and updates to *Coal* and *Uranium* during 2010. Further new profiles on *Tungsten* and *Tantalum and Niobium* will be added in the first quarter of 2011, together with an update to *Fluorspar*.

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 2011

CONTENTS

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 predecessors to this series entitled *World Mineral Statistics* and the *Statistical Summary of the Mineral Industry*. Many copies of these publications are available in the World Archive section of the website: www.mineralsUK.com.

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.

Exclusion of Warranty

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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, the Barytes Association 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; 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; Norilsk Nickel; 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; Energy Bangla, Bangladesh; Petrobangla, Bangladesh; Central Bank of Barbados; Federation de l'Industrie Cimentiere Belge, Belgium; Statistics Belgium; Instituto Nacional de Estatistica Boliva; Cámara Boliviana de Hidrocarburos, Bolivia; Republika Srpska Institute of Statistics, Bosnia & Herzegovina; 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; Danish Energy Agency, 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; Statistical Office of Kosovo; Statec, Luxembourg; Bank Negara Malaysia; Pemex, Mexico; Secteria de Economia, Mexico; Servicio Geologico de Mexico; Mineral Resources & Petroleum Authority of Mongolia; Statistics Office of Montenegro; Ministry of Mines and Energy, Namibia; 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; CemSuisse, Switzerland; 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 (6200 million tonnes), Vietnam (2100 million tonnes), Jamaica (2000 million tonnes) and Brazil (1900 million tonnes (Bray, 2010).

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 useful 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, 2009).

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, 2007).

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 and foil), water treatment, construction (windows, doors and 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 32 per cent to global production (IAI, 2010).

World production in 2009

World output of bauxite dropped in 2009 by seven per cent compared to 2008 as a result of the global recession, to 199 million tonnes. Australia remained the largest producer with its production increasing again by a further three per cent in 2009; its share of the world total also increased to 33 per cent. China overtook Brazil to become the second largest bauxite miner in the world with 15 per cent of the world's total output. China's production increased by 19 per cent in 2009 compared to 2008 and has risen by 72 per cent between 2005 and 2009. By contrast Brazil's output fell by seven per cent in 2009 compared to 2008. Other significant producers of bauxite are Indonesia (with eight per cent of the world's total), Guinea and India (seven per cent each). Jamaica, which once was a very significant producer, experienced the largest fall in output of any of the major producers in 2009, amounting to a 47 per cent drop compared to 2008.

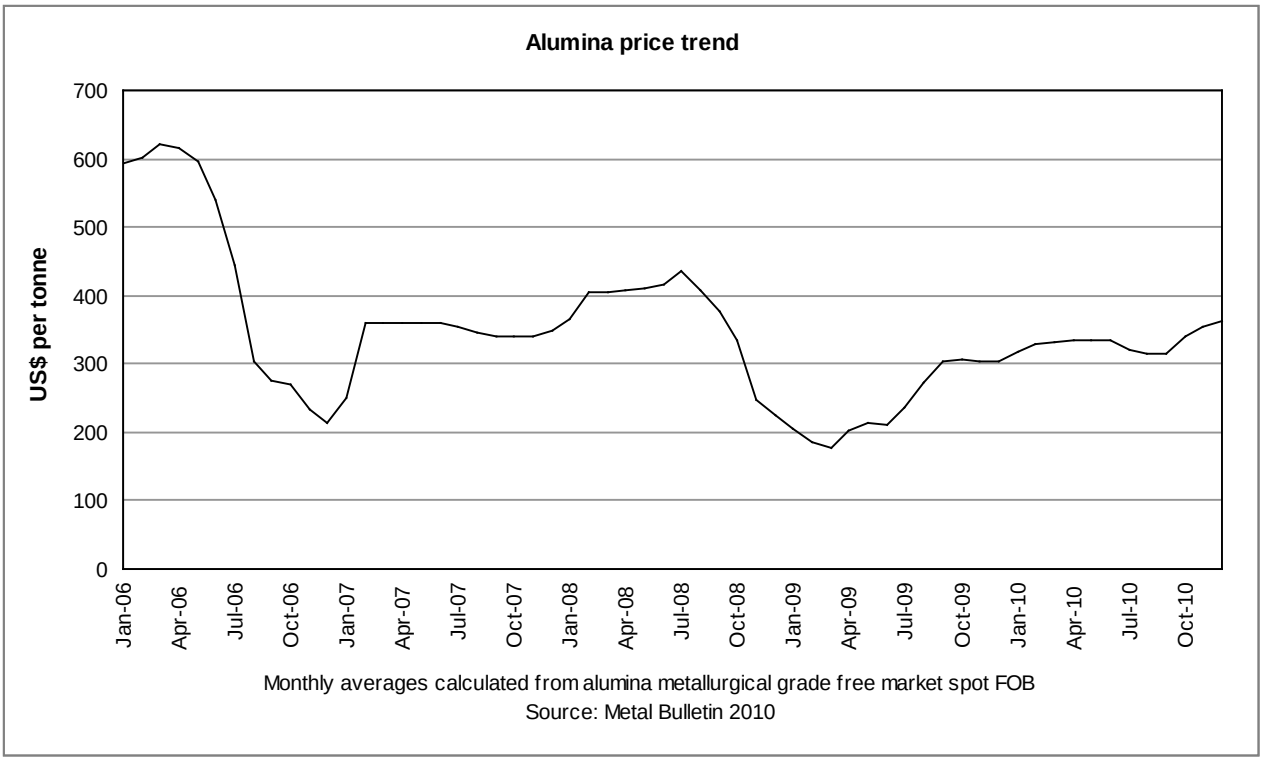
The global recession also contributed to a fall in alumina output in 2009, with a drop of six per cent compared to 2008. China remained the world's largest producer in 2009, with output increasing by four per cent compared to 2008. China's share of the world total has also increased significantly from 13 per cent in 2005 to 31 per cent in 2009. Australia continued as the second largest producer, with an increase of three per cent in 2009 compared to 2008 and a world share of 26 per cent (broadly similar to its share in 2005). Brazil's increasing alumina production trend also continued with a ten per cent rise in 2009 compared to 2008. Its output has increased by 66 per cent since 2005 and its share of the world total has also increased from eight per cent in 2005 to 11 per cent in 2009. Other significant producers in 2009 were the USA, India and Russia, which contributed four per cent each to the world's total.

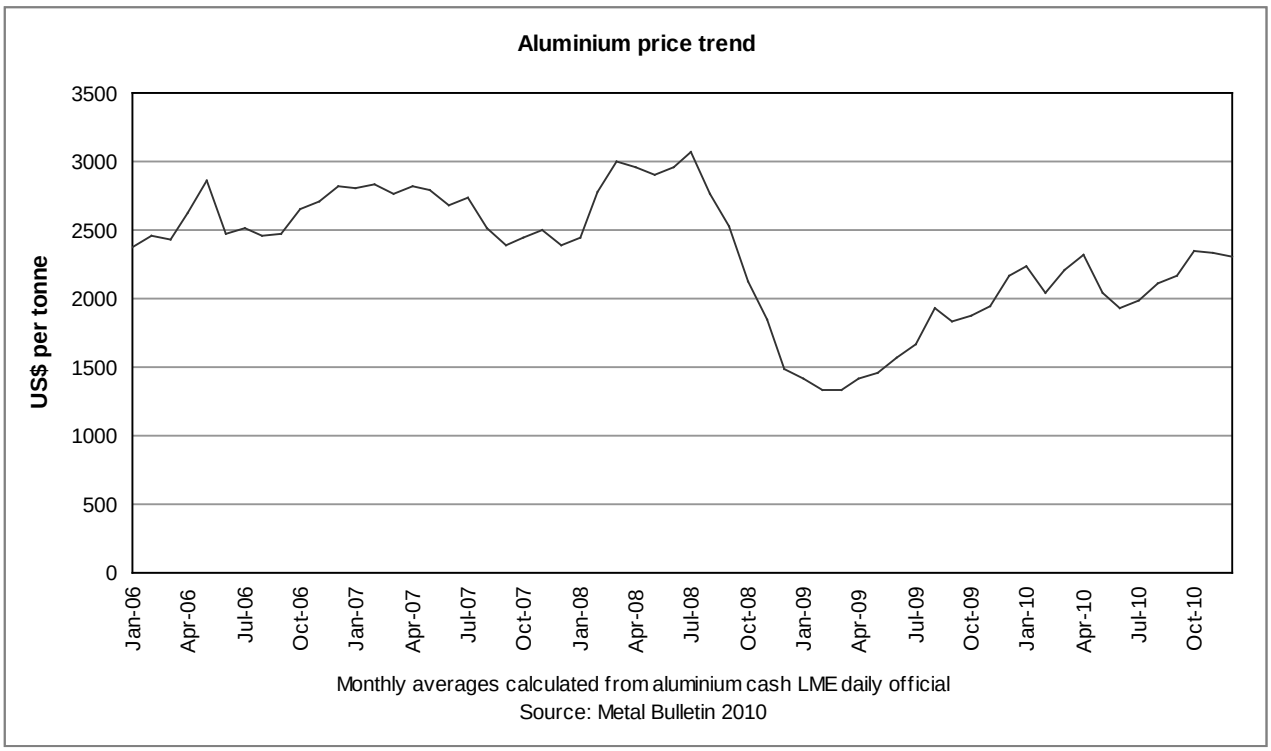
Global aluminium production fell by nearly seven per cent in 2009, compared to 2008, with all of the top eight producers experiencing some degree of falling output. China remained the world's largest producer but its output fell by 2.5 per cent in 2009 compared to 2008. However production in China has still increased by 65 per cent between 2005 and 2009, and in 2009 it represented 35 per cent of the world's total output (up from 24 per cent in 2005). Russia remained the second largest producer; contributing ten per cent to the world's total despite a nine per cent drop in output in 2009 compared to 2008. Canada continued as the world's third largest producer, with eight per cent of the total, followed by Australia and the USA with five per cent each. Australia moved ahead of the USA in terms of tonnage produced in 2009 but this was due to the USA experiencing a larger decline in output (35 per cent compared to Australia's 1.6 per cent fall).

Prices

Metallurgical grade bauxite is mostly traded on long-term contracts and prices are not published. In 2010, prices for refractory grade bauxite from China generally recovered from the falls caused by the recession and returned to the US$480 per tonne to US$535 per tonne range (Roberts, 2010).

Compared to the sharp fall and recovery in 2009, spot prices for metallurgical grade alumina were relatively stable throughout 2010. They started the year at US$295–US$315 per tonne and increased a little during the first half of the year to US$320–US$350 per tonne before falling slightly to US$300–US$330 per tonne for a three month period.





However, spot prices then rose to finish the year at US$360–UIS$370 per tonne (Metal Bulletin, 2010a).

The London Metal Exchange (LME) official daily cash price for aluminium ingot was also much more stable in 2010 compared to the dramatic fall and recovery experienced in 2008 and 2009 as a result of the global recession. Throughout

2010 it remained between US$1820 per tonne and US$2447 per tonne with high points in April and November and the low in June 2010. It finished the year at US$2296 per tonne (Metal Bulletin, 2010a).

Demand for aluminium continued to recover throughout 2010, but as it did so the supply more than kept up, with the result that stocks of the metal did not fall and the price did not increase to pre-recession levels. For many years global consumption has been less than production and although China is trying to close down its most inefficient production plants there are other new plants opening up there which will more than compensate in terms of overall capacity (Karpel, 2010).

Industry events in 2010

United Company Rusal were in the news at the start of 2010 with their initial public offering (IPO) on the Hong Kong stock exchange raising US$2.24 billion for the debt-burdened company (Chim and Ku, 2010). However, just a few days after the listing the UC Rusal share price had dropped by 10 per cent due to concerns relating to the aluminium price and UC Rusal's high levels of debt (Metal Bulletin, 2010b).

Electricity tariffs were the focus of attention in the European Union early in 2010 where the European Commission decided to investigate the rates charged to Aluminium of Greece, by the Greek state-owned Public Power Corp, to see if they represented an illegal state subsidy. Questions were also being asked about the tariffs paid by Alcoa at its aluminium smelters in both Italy and Spain. A decision requiring Alcoa to pay back a portion of its Italian energy tariff resulted in the closure of its two plants in Italy (Mason, 2010; Metal Bulletin 2010c).

Aluminium of Greece also experienced problems in the first half of 2010 as a result of the crisis surrounding the Greek economy, which saw domestic demand fall by a further 40 per cent compared to the previous year because the country's construction industry had collapsed. This weak demand in Greece was at odds with the rest of Europe, especially northern Europe, which had been experiencing a recovery compared to 2009. However, the company's parent, Mytilineos, was still able to secure credit and Aluminium of Greece hoped to return to full production in 2011 (Wallop, 2010a).

A severe power shortage caused problems in Venezuela early in 2010. The state-owned bauxite and alumina producer, Bauxilum, aluminium producers, Venalum and Alcasa, and aluminium products maker, Cabelum, all experienced cuts in power supply. All were forced to reduce output as a result of the power shortages, which were caused by a prolonged drought that reduced water levels at the country's giant Guri hydro-electric dam (Weik, 2010a). Low water levels in the Orinoco River were also preventing Bauxilum from transporting bauxite from the Pijiguaos mine to its alumina refinery at Puerto Ordaz (Weik, 2010b) but supplies resumed at the end of May when water levels increased (Metal Bulletin, 2010d).

Although Vedanta has commissioned its new alumina refinery at Lanjigarh and the first phase of its aluminium smelter in Jharsugda (both in Orissa, India) it has experienced significant problems in 2010 with the proposed bauxite mine at Niyamgiri that is intended to provide the raw feed for the complex. The local indigenous Dongria Kondh people protested that the mine would destroy forests that provide their livelihood and offend their tribal god. While the deadlock continued, Vedanta was forced to purchase bauxite from a variety of sources to feed its new plants (Bose, 2010). Amid accusations of pollution by Amnesty International, all of which were refuted by Vedanta, the Church of England and other investors decided to sell their stakes in the company (Wilshaw, 2010). Vedanta's mining application was then rejected by the country's Ministry of Environment and Forests on the grounds that the company had violated environmental laws and that allowing it further access to the proposed mining lease area would have serious consequences. The Orissa government was said to be actively considering alternative sources of bauxite for the Vedanta refinery (Mining Journal, 2010a and b).

Other proposals also exist to build aluminium complexes in Orissa, which contains almost half of India's bauxite deposits. These include the Hindalco refinery under construction at Kasipur, which will be linked to bauxite reserves in the Baphlimali hills by a 19.5 kilometre conveyor. There is also a new joint venture between Dubai Aluminium and engineering group Larson & Toubro, which have a bauxite reserve at Kuturmali-Sijimali and plan to build a three million tonnes per year alumina refinery and 440 000 tonnes per year aluminium smelter. After Vedanta's recent experiences, these proposals will be watched closely to see if they encounter similar problems relating to environmental protection and relationships with displaced people (Bose, 2010).

In May, Vale SA entered into an agreement with Norsk Hydro that means the latter will take over the world's third largest bauxite mine, Paragominas, the world's largest alumina refinery, Alunorte, and the Albras aluminium plant, all in Brazil. In return Vale will receive a 22 per cent stake in Norsk Hydro plus US$1.4 billion in cash payments (Mining Journal, 2010c). Meanwhile the commissioning of a second loading dock at Alunorte was delayed from June to at least August resulting in a backlog of ships, port congestion and delays in alumina supplies to customers (Riley, 2010).

Violent protests broke out in May at the Kombinat Aluminijuma Podgorica (KAP) plant in Montenegro, as around 200 workers and union leaders objected to the proposed implementation of job cuts, which were agreed last year with the Montenegrin government as part of a reorganisation of production and financial activities. The owners, Central Aluminium Company, part of the En+ Group who also own the largest stake in UC Rusal, claim that the plant continued to run normally throughout the disturbances. KAP accounts for 15 per cent of Montenegro's GDP and 50 per cent of that country's exports (Wallop, 2010b).

In June, Alcoa were forced to declare *force majeure* at its Aviles aluminium smelter in Spain following severe flooding in the region. The 93 000 tonnes per year plant had to be idled while the damage was assessed (Mineweb, 2010). In August, Norsk Hydro also to declared *force majeure* at its new Qatalum smelter in Qatar following a power failure during the plant's ramp-up schedule. The stoppage caused the temperature to drop in a number of the plant's production cells and resulted in the liquid electrolyte solidifying. This issue also resulted in the plant not reaching its design capacity during the year (Fouche, 2010). In August, Rio Tinto Alcan had to declare *force majeure* on casthouse products after a fire at its Isal operation in Straumsvik, Iceland which caused damage to 22 kilometres of electrical cables (Metal Bulletin, 2010e). In September, Alcoa had to do the same after a fire in the rolling mill at its Knoxville plant in the USA (Metal Bulletin, 2010f).

Many of these problems appear relatively minor compared to the 'ecological nightmare' that occurred in Hungary in early October, when a tailings dam failed at the Ajka Timfoldgyar alumina plant, killing at least four people and injuring more than 120 others. It was estimated that a million cubic metres of red mud poured from a tailings pond, covered an area of about 40 square kilometres and deposited thick sludge in nearby villages. Hundreds of people were evacuated but their livestock were destroyed and many homes, roads and bridges were damaged (Kosich, 2010a; MIA, 2010). An emergency containment dam was built around part of the tailings reservoir as other parts of the wall developed cracks and a second failure was feared (MIA, 2010). There are also concerns about the ecological effects of the highly alkaline waste as it entered nearby water courses which feed into the River Danube (Kosich, 2010b). The clean-up process will take many months.

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Production of bauxite

tonnes (metric)

Country	2005	2006	2007	2008	2009
Bosnia & Herzegovina	1 031 600	854 047	866 933	1 018 333	555 820
France	175 000	160 000	* 160 000	* 160 000	* 160 000
Greece	2 441 443	2 162 900	2 125 900	2 174 000	1 935 000
Hungary	535 337	538 258	546 310	511 337	267 000
Montenegro	—	659 370	667 053	671 811	45 779
Russia	6 409 300	6 399 200	6 053 900	5 675 000	5 775 000
Serbia and Montenegro	672 345	—	—	—	—
Turkey	356 480	771 227	863 404	* 900 000	406 700
Ghana	606 700	841 775	1 033 368	796 000	440 000
Guinea	19 237 300	18 783 928	18 519 010	17 682 330	14 774 240
Mozambique	9 518	11 069	8 650	5 443	3 600
Sierra Leone	—	1 071 140	1 169 036	954 370	757 000
Tanzania	1 640	5 373	5 003	20 601	122 920
Jamaica	14 116 393	14 865 351	14 567 738	14 636 102	7 817 500
USA (a)	121 187	361 047	141 914	98 796	30 240
Brazil (b)	22 364 600	23 236 300	25 460 700	28 097 500	26 074 400
Guyana	1 694 126	1 478 670	2 242 928	2 092 237	1 484 935
Suriname	4 756 998	4 945 353	5 273 195	5 333 031	3 388 419
Venezuela	5 900 000	5 928 000	5 323 300	4 192 000	4 267 200
China	17 408 200	18 981 600	20 446 000	25 176 900	* 30 000 000
India (c)	12 595 803	15 732 535	22 624 960	15 554 385	14 048 000
Indonesia	* 2 700 000	* 9 000 000	* 16 000 000	* 18 000 000	* 15 000 000
Iran (d)	437 595	* 500 000	520 800	* 520 000	322 800
Iraq	—	—	—	4 928	250
Kazakhstan	4 815 400	4 883 800	4 962 600	5 160 100	5 131 000
Malaysia	4 735	91 806	156 785	295 176	263 432
Pakistan (e)	6 504	7 831	18 082	36 000	* 25 000
Vietnam	55 000	60 000	* 80 000	* 80 000	* 80 000
Australia	59 959 000	61 781 000	62 428 000	64 038 000	65 843 000
World Total	178 000 000	194 000 000	212 000 000	214 000 000	199 000 000

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

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

Production of alumina

tonnes (Al_2O_3 content)

Country	2005	2006	2007	2008	2009
Azerbaijan	314 764	362 665	184 500	164 879	9 590
Bosnia & Herzegovina	447 260	393 580	303 799	294 455	191 792
France	* 600 000	* 636 000	* 600 000	* 572 000	* 317 000
Germany	* 830 000	* 850 000	* 900 000	* 900 000	* 900 000
Greece	782 000	780 000	761 746	771 769	718 797
Hungary	* 305 000	* 301 000	* 301 000	* 299 000	* 185 000
Ireland, Republic of	* 1 800 000	1 800 000	1 800 000	1 890 000	1 240 000
Italy	1 070 000	1 090 000	1 327 000	1 045 000	92 000
Montenegro	—	236 740	240 186	220 426	58 528
Romania	689 329	622 083	22 830	344	44 000
Russia	3 259 216	3 265 216	3 332 308	3 112 000	2 794 000
Serbia and Montenegro	235 196	—	—	—	—
Spain	* 1 400 000	* 1 400 000	* 1 300 000	* 1 300 000	* 1 300 000
Turkey	112 558	150 117	163 435	* 150 000	* 150 000
Ukraine	1 632 020	1 671 620	1 655 718	1 673 000	1 524 000
Guinea	722 370	529 200	542 100	593 000	530 000
Canada	1 400 340	1 476 959	1 454 390	1 491 523	1 232 604
Jamaica	4 085 634	4 099 548	3 940 589	3 995 358	1 773 600
USA	5 215 000	4 696 000	4 236 000	4 298 000	3 064 000
Brazil	5 191 100	6 735 000	7 077 600	7 822 300	8 625 100
Suriname	1 939 615	2 151 148	2 178 472	2 153 968	1 536 187
Venezuela	1 931 000	1 920 000	1 751 000	1 591 300	1 370 000
China	8 592 200	13 256 900	19 453 000	22 788 100	23 793 000
India	3 066 000	3 077 000	3 208 000	* 3 000 000	* 3 000 000
Iran (a)	130 100	167 783	220 000	* 220 000	* 200 000
Japan	* 780 000	* 780 000	* 650 000	* 600 000	* 550 000
Kazakhstan	1 505 415	1 514 509	1 544 462	1 607 829	1 706 000
Australia	17 704 000	18 312 000	18 844 000	19 446 000	19 939 000
World Total	65 700 000	72 300 000	78 000 000	82 000 000	76 800 000

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 (metric)

Country	2005	2006	2007	2008	2009
Azerbaijan	31 762	31 852	39 241	61 604	10 145
Bosnia & Herzegovina	131 094	136 190	147 193	155 909	130 042
France	440 000	442 879	430 159	389 000	345 000
Germany	647 900	515 539	551 000	605 880	291 750
Greece	165 300	164 500	167 937	162 339	134 737
Hungary	31 000	300	—	—	—
Iceland	273 318	328 424	446 297	761 204	813 880
Italy	192 900	194 200	179 500	186 400	165 800
Montenegro	—	121 762	135 151	111 513	63 600
Netherlands	333 820	285 317	296 900	317 000	306 000
Norway	1 391 000	1 383 000	1 362 000	1 368 000	1 090 000
Poland	53 582	55 939	53 379	46 730	16 851
Romania	243 607	262 056	283 449	288 156	228 630
Russia	3 647 061	3 117 249	3 955 417	4 190 000	3 815 000
Serbia and Montenegro	116 994	—	—	—	—
Slovakia	159 203	158 289	160 461	162 995	149 604
Slovenia	138 500	118 100	111 016	83 300	35 148
Spain	394 200	367 400	405 100	405 800	334 600
Sweden	102 107	101 668	99 842	81 913	69 708
Switzerland	44 800	12 000	—	—	—
Turkey	59 000	60 000	63 400	61 100	30 000
Ukraine	114 213	112 952	113 437	88 800	45 900
United Kingdom	368 477	360 325	364 595	326 900	313 702
Cameroon	86 400	88 400	87 000	89 700	73 000
Egypt	243 800	252 300	258 300	259 200	245 400
Ghana	13 400	75 800	12 900	9 300	—
Mozambique	553 700	564 000	559 900	536 000	544 700
Nigeria	—	—	—	10 600	12 900
South Africa	846 213	895 000	899 000	811 000	809 000
Canada	2 894 204	3 051 128	3 082 625	3 120 148	3 030 269
USA	2 481 000	2 283 800	2 553 900	2 658 300	1 727 200
Argentina	275 071	277 800	292 744	399 714	406 655
Brazil	1 497 600	1 604 500	1 654 800	1 661 000	1 535 900
Venezuela	624 000	617 100	615 700	607 800	561 100
Bahrain	749 987	872 393	865 883	871 658	850 000
China	7 806 000	9 358 400	12 558 600	13 178 200	12 846 000
India (a)	930 543	1 113 849	1 239 581	1 347 127	* 1 302 100
Indonesia	252 300	250 300	242 100	242 500	257 600
Iran (b)	218 754	205 462	215 981	241 300	281 300
Japan	6 400	6 500	6 600	6 600	5 100
Kazakhstan	—	—	12 000	106 000	128 000
Oman	—	—	—	49 000	351 000
Tajikistan	379 630	413 800	419 060	399 500	359 400
United Arab Emirates	724 565	789 341	889 548	891 723	1 009 800
Australia	1 903 000	1 929 000	1 957 000	1 974 000	1 943 000
New Zealand	351 449	335 300	351 100	315 500	271 000
World Total	31 900 000	33 300 000	38 100 000	39 600 000	36 900 000

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

Mine production of antimony

tonnes (metal content)

Country	2005	2006	2007	2008	2009
Russia	* 3 000	* 3 000	* 3 000	* 3 000	* 3 000
Turkey	* 1 200	* 1 100	* 1 200	* 1 300	* 1 300
South Africa	6 098	4 443	3 436	3 674	2 090
Canada	79	269	193	132	66
Guatemala	1 007	—	365	—	—
Mexico	565	778	414	380	74
Bolivia	5 204	5 460	3 881	3 905	2 990
Peru (a)	807	691	590	531	145
China	151 457	156 200	163 000	183 000	166 200
Kyrgyzstan	* 250	* 250	* 250	* 250	918
Pakistan (b)	5	91	119	245	* 250
Tajikistan	4 073	3 480	—	—	—
Thailand	415	544	271	422	555
Australia (b)	192	230	767	1 688	1 794
World Total	174 000	177 000	177 000	199 000	179 000

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 (metric)

Country	2005	2006	2007	2008	2009
Belgium	* 1 000	* 1 000	* 1 000	* 1 000	* 1 000
Portugal	* 15	* 15	* 15	* 15	* 15
Russia	* 1 500	* 1 500	* 1 500	* 1 500	* 1 500
Namibia	29	—	610	574	* 600
Canada	* 250	* 250	* 250	* 250	* 250
Mexico	2 197	2 106	677	—	—
Bolivia	120	90	* 80	74	115
Chile (a)	* 10 000	* 10 000	* 10 000	* 10 000	* 10 000
Peru	3 150	4 399	4 321	4 822	300
China	* 30 000	* 30 000	* 25 000	* 25 000	* 25 000
Iran (b)	* 100	* 100	* 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) Exports
(b) Orpiment and realgar concentrates

Production of asbestos

tonnes (metric)

Country	2005	2006	2007	2008	2009
Russia	* 925 000	* 925 000	1 025 000	1 017 000	1 000 000
Serbia	—	4 500	—	—	—
Serbia and Montenegro	4 080	—	—	—	—
Slovakia	1 000	1 000	400	200	—
Zimbabwe					
Chrysotile	122 041	96 956	84 520	11 489	4 971
Canada					
Chrysotile	* 200 000	* 200 000	* 180 000	* 160 000	* 150 000
Argentina	260	299	282	298	322
Brazil	236 047	227 304	254 204	305 000	288 400
Colombia (a)	* 60 000	* 60 000	* 60 000	* 60 000	* 60 000
China	332 407	360 000	* 390 000	* 380 000	* 380 000
India					
Amphibole (b)	2 323	390	269	317	248
Iran (c)	1 300	—	—	—	—
Kazakhstan	305 500	314 700	292 600	230 100	230 000
World Total	2 200 000	2 200 000	2 300 000	2 200 000	2 100 000

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

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

Production of barytes

tonnes (metric)

Country	2005	2006	2007	2008	2009
Bosnia & Herzegovina	160	190	37	54	30
Bulgaria	76 600	74 500	50 900	40 100	14 300
France	* 81 000	* 40 000	—	—	—
Germany	88 591	85 524	88 265	78 941	45 606
Italy	7 312	* 7 000	* 7 000	* 7 000	* 7 000
Poland	2 357	2 034	2 000	308	300
Portugal	21	24	25	171	1 078
Russia	63 400	63 000	64 000	64 000	64 000
Slovakia	26 589	57 000	58 000	20 000	30 000
Spain	42 792	45 001	26 770	11 100	2 814
Turkey	157 200	160 000	150 000	150 000	150 000
United Kingdom	64 000	48 000	53 000	43 000	36 000
Algeria	54 773	64 787	63 098	60 088	37 981
Egypt	…	…	50	1 080	* 1 000
Morocco	597 600	628 400	664 708	725 060	586 900
Nigeria	* 30 000	30 011	18 047	* 16 000	14 314
Canada	23 000	21 000	9 000	12 300	15 000
Mexico	268 657	199 605	185 921	140 066	152 791
USA (a)	489 000	598 000	455 000	648 000	* 380 000
Argentina	3 355	6 276	3 798	3 170	3 416
Bolivia	11 379	8 943	8 245	10 900	1 900
Brazil (b)	42 924	47 611	37 000	42 000	* 40 000
Chile	91	375	77	—	—
Colombia	* 2 000	* 2 000	* 2 000	* 2 000	* 2 000
Peru	26 985	1 899	27 369	45 199	27 875
Afghanistan	* 1 500	* 1 500	* 1 500	* 1 500	1 000
Burma (c)	2 205	6 923	5 918	6 622	7 120
China	4 100 000	4 600 000	4 300 000	5 000 000	2 900 000
India (c)	1 156 227	1 680 695	1 076 290	1 682 496	2 137 771
Iran (d)	231 184	226 032	249 495	226 590	200 000
Kazakhstan	95 000	95 000	95 000	95 000	90 000
Laos	28 500	29 000	29 000	29 000	29 000
Malaysia	—	910	—	4 372	15 880
Pakistan (e)	42 087	44 183	46 155	43 000	42 000
Saudi Arabia	30 000	31 000	30 000	30 000	…
Thailand	3 989	4 549	8 631	9 180	9 000
Vietnam	116 000	90 000	90 000	80 000	70 000
Australia	18 020	* 18 000	* 12 600	* 22 400	* 16 800
World Total	8 000 000	9 000 000	7 900 000	9 400 000	7 100 000

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

Production of bentonite and fuller's earth

tonnes (metric)

Country	2005	2006	2007	2008	2009
Armenia					
Bentonite	732	720	1 129	50	238
Azerbaijan					
Bentonite	53 700	40 600	50 459	40 683	10 581
Bosnia & Herzegovina					
Bentonite (a)	24 882	24 645	32 912	30 504	16 042
Bulgaria					
Bentonite	181 200	134 500	99 000	178 700	108 400
Croatia					
Bentonite	17 391	16 410	19 578	19 759	* 20 000
Cyprus					
Bentonite	172 366	150 620	154 655	155 125	152 722
Czech Republic					
Bentonite	216 000	267 000	335 000	235 000	181 000
Denmark					
Bentonite	18 515	19 211	20 093	22 458	24 040
Georgia					
Bentonite	7 876	4 487	—	—	—
Germany					
Bentonite	352 374	363 998	384 709	414 336	326 461
Greece					
Bentonite	1 124 795	* 1 200 000	(a) 1 389 800	(a) 1 528 584	(a) 926 186
Hungary					
Bentonite	4 900	6 635	54 231	7 464	2 839
Italy					
Bentonite	445 573	469 654	599 735	281 119	146 318
Kosovo					
Bentonite	—	—	—	20 800	35 600
Macedonia					
Bentonite	14 958	20 353	22 509	13 689	9 033
Poland	86 331	97 900	105 943	121 031	81 354
Romania					
Bentonite	18 190	21 165	16 911	16 638	13 694
Russia					
Bentonite	* 500 000	456 000	* 460 000	* 460 000	* 460 000
Slovakia					
Bentonite	97 000	136 000	149 000	145 000	109 000
Spain					
Bentonite	163 290	154 746	147 253	154 534	* 140 000
Attapulgite	20 565	20 933	24 615	27 348	21 110
Sepiolite	807 820	806 345	717 728	737 659	573 937
Turkey					
Bentonite	582 735	* 600 000	748 170	683 253	753 155
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	6 200	—	—	—	—
Algeria					
Bentonite	29 029	27 110	32 600	30 595	31 612
Fuller's earth	831	—	—	—	—
Egypt					
Bentonite (c)	* 19 000	* 19 000	19 200	28 320	35 384
Morocco					
Bentonite	64 000	21 100	136 097	50 125	84 100
Fuller's earth (d)	30 600	29 400	121 737	140 875	132 100
Mozambique					
Bentonite	547	692	762	614	* 600
Senegal					
Attapulgite	127 000	140 000	* 150 000	166 900	180 900
South Africa					
Bentonite	139 883	32 878	45 778	44 067	40 340
Attapulgite	34 340	49 225	65 402	69 876	52 103

Production of bentonite and fuller's earth

tonnes (metric)

Country	2005	2006	2007	2008	2009
Guatemala					
Bentonite	135 451	20 034	259 799	62 749	14 287
Mexico					
Bentonite	425 630	435 273	613 895	374 933	511 430
Fuller's earth	107 265	102 400	34 175	66 123	108 139
USA					
Bentonite (e)	4 710 000	4 940 000	4 820 000	4 900 000	* 4 100 000
Fuller's earth (e)	2 730 000	2 540 000	2 660 000	2 510 000	* 2 360 000
Argentina					
Bentonite	247 101	256 165	250 260	265 782	148 099
Fuller's earth	* 1 500	* 1 500	* 1 500	* 1 500	* 1 500
Brazil					
Bentonite	459 679	419 214	329 647	340 141	* 340 000
Chile					
Bentonite	—	—	533	—	—
Colombia					
Bentonite	* 8 500	* 8 500	* 8 500	* 8 500	* 8 500
Peru					
Bentonite	14 663	14 590	21 451	31 557	119 495
Uruguay					
Bentonite	200	510	530	310	* 300
Burma					
Bentonite (f)	602	904	* 900	* 900	* 900
China					
Bentonite	2 300 000	3 200 000	* 3 300 000	* 3 300 000	* 3 400 000
India					
Bentonite (f)	* 590 000	* 601 000	* 579 000	* 700 000	* 560 000
Fuller's earth (f)	* 83 000	* 42 000	* 89 000	* 29 000	…
Indonesia					
Bentonite	* 5 000	* 5 500	* 5 500	* 6 000	* 6 000
Iran					
Bentonite (g)	261 888	186 323	254 084	375 898	* 376 000
Iraq					
Bentonite	...	...	570	1 605	3 959
Japan					
Bentonite	421 629	* 425 000	* 430 000	* 435 000	* 435 000
Fuller's earth	* 110 000	* 110 000	* 110 000	* 110 000	* 110 000
Korea (Rep. of)					
Bentonite	85 177	61 137	56 429	71 052	84 963
Fuller's earth	84 632	46 314	65 136	70 711	99 802
Pakistan					
Bentonite (c)	15 671	20 088	33 177	31 000	* 31 000
Fuller's earth (c)	17 001	16 209	11 378	11 000	* 11 000
Philippines					
Bentonite	* 2 000	1 000	1 148	1 422	1 413
Thailand					
Bentonite	32 500	1 200	650	210	…
Uzbekistan					
Bentonite	* 35 000	* 40 000	* 40 000	* 40 000	* 40 000
Vietnam					
Bentonite	* 20 000	* 20 000	* 20 000	* 20 000	* 20 000

Production of bentonite and fuller's earth

tonnes (metric)

Country	2005	2006	2007	2008	2009
Australia					
Bentonite (c)	227 433	* 125 600	* 116 300	* 80 400	* 133 500
Fuller's earth	9 784	* 10 000	* 10 000	* 10 000	* 10 000
New Zealand					
Bentonite	7 590	3 028	6 154	753	880
World Total Bentonite	14 400 000	15 100 000	16 200 000	15 800 000	14 200 000
World Total Fuller's Earth (a)	4 200 000	3 900 000	4 100 000	4 000 000	3 700 000

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

Production of beryl

tonnes (metric)

Country	2005	2006	2007	2008	2009
Madagascar (a)	* 1	* 1	* 1	* 1	* 1
Mozambique	146	16	31	8	* 10
Uganda	19	2	2	—	—
Zambia	* 10	* 10	* 10	* 10	* 10
USA	2 780	3 830	3 810	4 410	* 3 000
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	2005	2006	2007	2008	2009
Bulgaria	* 40	* 45	* 45	* 45	...
Romania	* 40	* 40	* 40	* 40	* 40
Russia	* 50	* 55	* 55	* 70	* 70
Canada	170	214	145	71	86
Mexico	970	1 186	1 170	1 132	854
Bolivia	44	155	147	28	54
Peru (a)	952	1 081	1 114	1 061	423
China	1 886	1 515	1 363	1 453	1 460
Japan (a)	463	425	408	480	423
Kazakhstan	* 140	* 140	* 145	* 150	* 140
Australia	* 100	* 100	* 100	* 100	* 100
World Total	4 900	5 000	4 700	4 600	3 700

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) Metal production

Production of borates

tonnes (metric)

Country	2005	2006	2007	2008	2009
Russia	* 400 000	* 400 000	* 400 000	* 400 000	* 410 000
Turkey	2 087 000	2 373 345	1 997 163	2 139 224	1 682 000
USA (a)	1 150 000	* 1 150 000	* 1 150 000	* 1 150 000	* 1 200 000
Argentina	632 792	533 535	669 578	789 954	500 433
Bolivia	63 499	50 727	79 531	66 249	93 829
Chile	460 683	459 645	535 071	590 999	613 135
Peru	32 611	—	233 991	349 891	187 221
China	* 280 000	* 290 000	* 290 000	* 280 000	* 290 000
Iran (b)	1 660	1 974	1 603	1 020	* 1 000
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	2005	2006	2007	2008	2009
Russia	* 60 000	* 60 000	* 60 000	* 60 000	* 60 000
Spain	* 100 000	* 100 000	* 100 000	* 100 000	* 100 000
Ukraine	3 138 000	* 700 000	* 1 800 000	* 400 000	* 400 000
USA (a)	226 000 000	243 000 000	* 235 000 000	* 230 000 000	* 230 000 000
China	* 104 000 000	* 124 000 000	* 137 000 000	* 135 000 000	* 140 000 000
India (b)	2 424 000	2 138 000	1 664 640	2 118 740	1 862 580
Israel	207 048 000	179 493 000	159 395 000	164 042 000	127 689 000
Japan	* 20 000 000	* 20 000 000	* 20 000 000	* 20 000 000	* 20 000 000
Jordan	89 785	94 500	85 105	105 600	69 000
World Total	563 000 000	570 000 000	555 000 000	552 000 000	520 000 000

Note(s)
(a) Elemental bromine sold as such or used in the preparation of bromine compounds by primary producers
(b) Years ended 31 March following that stated

Production of cadmium

tonnes (metric)

Country	2005	2006	2007	2008	2009
Bulgaria	319	320	318	376	413
France	* 100	* 90	* 50	* 50	* 50
Germany	* 490	* 490	* 475	* 420	* 250
Netherlands	494	524	495	530	490
Norway	153	125	269	178	249
Poland	408	373	421	603	534
Russia	621	690	810	* 800	* 700
Canada (a)	1 727	2 090	1 388	1 409	1 299
Mexico	1 627	1 399	1 605	1 550	1 510
USA (a)	1 470	723	735	777	633
Argentina	3	6	35	38	36
Brazil	200	* 200	* 200	* 200	* 200
Peru	481	416	347	371	289
China	4 080	3 791	4 215	6 964	* 7 000
India (b)	406	481	589	589	541
Japan	2 297	2 286	1 939	2 126	1 824
Kazakhstan	1 624	1 140	996	996	996
Korea (Rep. of)	2 582	3 320	2 846	3 090	2 500
Korea, Dem. P.R. of	* 200	* 200	* 200	* 200	* 200
Australia	358	329	351	* 350	* 370
World Total	19 600	19 000	18 300	21 600	20 100

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 (metric)

Country	2005	2006	2007	2008	2009
Albania	170 000	187 070	194 760	232 040	274 140
Finland	572 000	549 000	556 000	614 000	247 000
Kosovo	...	...	...	—	2 000
Russia	772 000	966 095	776 681	913 000	416 194
Turkey	858 729	1 059 901	1 678 932	1 885 712	1 770 029
Madagascar	93 384	116 290	122 260	84 000	60 000
South Africa	7 502 762	7 418 326	9 646 958	9 682 640	6 864 938
Sudan	21 654	24 200	37 656	27 094	14 087
Zimbabwe	667 199	700 001	614 559	442 584	193 674
Cuba	14 792	5 047	—	—	—
Brazil	616 534	562 739	627 772	* 700 000	* 700 000
Afghanistan	6 818	* 6 800	* 6 800	* 6 800	* 7 000
Burma (a)	* 410	* —	* —	* —	* —
China	220 000	220 000	220 000	220 000	280 000
India (a)	3 714 284	5 295 551	4 872 847	3 980 582	3 372 000
Iran (b)(c)	224 911	236 397	139 114	268 586	255 129
Kazakhstan	3 581 242	3 366 078	3 687 200	3 551 700	3 333 197
Oman	34 000	276 300	407 800	784 100	730 000
Pakistan (d)	56 359	64 572	104 141	115 000	* 92 000
Philippines (b)	36 070	46 728	31 593	15 268	14 322
United Arab Emirates	—	—	19 000	34 350	23 770
Vietnam	5 700	3 400	2 800	* 1 300	* 400
Australia	90 260	107 103	118 093	56 881	74 789
World Total	19 200 000	21 200 000	23 900 000	23 600 000	18 700 000

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 '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 (BGS, 2010).

Uses

Power generation is the primary use for coal. Roughly 41 per cent of electricity worldwide (World Coal Association, 2010a) is generated from coal and this may be considerably higher in many individual countries. In the USA, for example, 49 per cent of the electricity generated is through coal-fired power stations (World Coal Association, 2010b) and in China, 79 per cent (World Coal Association, 2010b). Approximately 27 per cent of world primary energy consumption is from coal (World Coal Association, 2010a).

Almost two-thirds of world steel production is made from iron produced in blast furnaces that 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 that 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 comes 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.

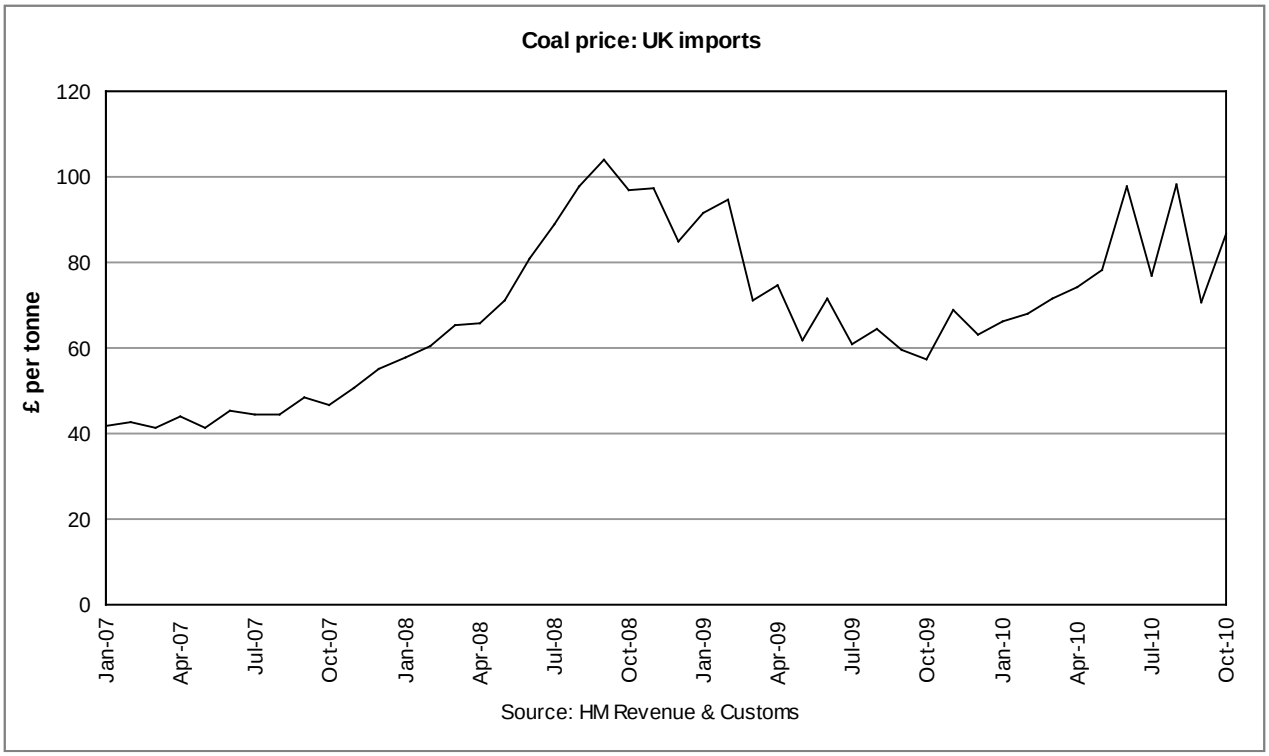
World Production in 2009

In 2009, world coal production was 6938 million tonnes; this is an increase of 3138 million tonnes, or nearly five per cent, compared to 2008. During the period 2005–2009, world production has increased by between three and five per cent per year, and by 18 per cent overall. China continues to be the largest producer with 3050 million tonnes, which is almost 44 per cent of total world production. In 2009 China's output increased by 16 per cent compared to 2008; a significantly greater increase than the three per cent achieved the year before. Overall China's production increased 38 per cent between 2005 and 2009. The USA remains the second largest producer of coal with 975 million tonnes, with India third at 566 million tonnes. This represents 14 per cent and eight per cent of total world coal production respectively.

Coal production in Europe has been fairly static with increases between 2005 and 2008 of around one per cent per year. However, between 2008 and 2009 there was a decrease in production of seven per cent as output from most countries fell. The largest producer of coal in Europe is Russia, which had a nine per cent increase in production between 2005 and 2008, but in 2009 production fell by nine per cent compared to 2008. The biggest percentage decreases in output during 2009 were from Montenegro (down 45 per cent), Ukraine (30 per cent) and Norway (29 per cent). Few countries in Europe increased production; most notable amongst these was Albania which quadrupled its production compared to 2008. However, between 2005 and 2008 Albania's production dropped from 19 000 tonnes to 1500 tonnes, a decrease of 92 per cent. The other countries where production increased in 2009 were Serbia, Slovakia and Bosnia & Herzegovina.

Asia had the largest growth in coal production of all the regions of the world. The increase between 2008 and 2009 was over 13 per cent, and between 2005 and 2009, production has grown by 37 per cent. The biggest percentage increase in production during 2008 and 2009 in the region was Malaysia at 83 per cent, with an output of more then two million tonnes for the first time. Afghanistan also shows one of the largest increases in production at 44 per cent between 2008 and 2009, followed by Bangladesh whose production for 2009 was 42 per cent higher than 2008, although both countries' output is less than a million tonnes per year.

The majority of coal production in 2009 in the Americas was from the USA. Although generally increasing in output between 2005 and 2008, production from the USA decreased by eight per cent between 2008 and 2009. While significantly



smaller producers than the USA, there are other countries in this region that have shown substantial growth in their outputs between 2005 and 2009. These include Peru at 429 per cent growth and Mexico at 96 per cent.

Australia is the world's fourth largest producer of coal but its production grew by only four per cent in 2009. New Zealand's production of coal decreased between 2008 and 2009 by seven per cent, but its output since 2005 has decreased overall by 13 per cent.

Africa's coal production remained fairly static with a slight decrease of 0.65 per cent in the period 2008 to 2009. Africa's biggest producer, South Africa, maintained its output, with a decrease in production of 0.65 per cent in the same period. The biggest increase, at 23 per cent between 2008 and 2009, was Niger.

Prices

The price of coal is determined by a range of factors including coal type, net calorific value and content of impurities such as sulphur. Additionally, the cost of transportation comprises a large portion 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.

During 2009, energy consumption was driven lower by the global economic recession, particularly in OECD (member countries of the Organisation for Economic Co-operation and Development) and FSU (former Soviet Union) countries, and this continued to influence the price of coal during 2009. Global primary energy consumption fell by 1.1 per cent in 2009, the largest decline since 1980. Only in Asia Pacific and the Middle East has energy consumption increased. Oil, natural gas and nuclear power consumption all declined with coal overall remaining generally the same, while hydro-electric and other renewable production increased. Coal's share of world energy consumption is now 29.4 percent which is the highest since 1970 (BP, 2010).

Asian coal prices have fallen less sharply than other regions, due to increasing import demand from China (BP, 2010). The BP Statistical Review of World Energy 2010 shows the value of coal production falling dramatically between 2008 and 2009 by 52 per cent in North West Europe, 43 per cent in US Central Appalachian, six per cent for coking coal in Japan and ten per cent for steam coal in Japan (BP, 2010). However, towards the end of 2009, the price of coal stabilised and by December 2010 it had increased to US$126.85 (RB™ Index US$/t Global Coal Data Weekly Index 31st Dec 2010) (Global Coal, 2011). The price of coal imports to the UK has been quite volatile in 2010, but has followed a generally upward trend since a low in October 2009 (HM Revenue & Customs, 2010).

Industry events in 2010

Although China's GDP growth slowed during the global economic recession, from 13 per cent in 2007 (Pitfield et. al, 2010) to an estimated ten per cent in 2010 (CIA, 2011), China still increased its coal fired electricity generation capacity by 51 gigawatts in 2010. India has also become a large importer of coal and it would seam clear that emerging markets will continue to have a huge impact on the value of commodities in the future (Guardian, 2011).

India's largest importer of coal, Adani Enterprises, bought assets from Austrailia's Linc Energy for US$2.72 billion in August 2010. India has a growing need for energy as it strives for double digit GDP growth. India's demand for thermal coal is expected to increase by 90 per cent in the next five years as more projects to build bridges and roads start up. The Indian Government estimates that it faces a nearly 50 million tonne shortage by the end of March 2011 and independent analysts foresee a shortage of 200 million tonnes by 2012 with power projects doubling by that date (FT, 2010a).

One of China's largest steel producers, Wuhan Iron and Steel, acquired an eight per cent share of the Australian-listed company Riverside in June. The company is developing coalfields in Mozambique's Tete province and has committed to extra investment in the Zambeze coal project. Riverside's two coal concessions in Benga and Zambeze are amongst the largest reserves in the world at 13 billion tonnes (FT, 2010b)

There have been a number of high profile accidents in mines during 2010. In April, the USA had one of its worst coal disasters in 40 years when a blast at Massey Energy's Upper Branch mine in West Virginia killed 29 workers (Bloomburg Business Week, 2010b). In China, a blast killed 47 miners at the Xingdong No 2 Mine in June 2010, although 28 miners survived the accident. The mine was being operated illegally due to expiry of its licence (China Daily, 2010). In Columbia in June, 20 workers were killed and a further 58 were trapped following an explosion (Bloomburg Business Week, 2010a). In New Zealand in November 2010, at the Pike River Coal Mine, 29 miners were killed in an explosion. This was the country's worst mining disaster in almost a century. The operating company, of which New Zealand Oil and Gas is a 29 per cent owner, has since gone into receivership (BBC, 2010).

The United Nations Climate Change Conference took place in Cancun in Mexico in December 2010. One of the outcomes was the agreement to include carbon capture and storage within the Clean Development Mechanism (CDM). More work needs to be done to develop a framework of how Carbon Capture and Sequestration (CCS) will work in the CDM. This decision is described as a 'major triumph' as developing countries will be able to access support to implement the latest clean coal technologies to facilitate their domestic energy needs (World Coal Association, 2010c).

In Indonesia, in December 2010, Australian firm, Kangaroo Resources Ltd has become a world scale coal producer when it bought at 99 per cent stake in the Pakar Thermal coal project in East Kalimantan from PT Bayan Resources. Pakar has reserves of 116 million tonnes of coal (Mineweb, 2010).

The end of 2010 saw more than two months of torrential rain in Queensland Australia. Australia is the world's largest exporter of coal for steel making and the flooding has filled mines and interrupted rail lines, severely hampering output. The result has been to increase coal prices in Asia as the region's steel mills struggle to find new suppliers to cover the shortfall. Spot prices are predicted to reach US$300 per tonne which is ten per cent higher than the industry benchmark of US$225 a tonne free on board, a figure Australian ports negotiated between BHP Billiton and Japanese steelmakers for the first quarter of 2011. The last time that Australia cut production, Japanese mills sourced coal from Canada and slightly cut production (Yahoo Finance, 2010).

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Production of coal

tonnes (metric)

Country	2005	2006	2007	2008	2009
Albania					
Lignite	19 000	3 800	2 700	1 500	7 840
Austria					
Brown coal & lignite (a)	13 931	7 854	—	—	—
Bosnia & Herzegovina					
Brown coal & lignite	9 144 850	9 958 024	9 762 800	11 221 305	11 517 701
Bulgaria					
Lignite	22 146 100	22 749 500	25 325 000	26 007 800	25 014 800
Brown coal	2 469 200	2 556 900	2 833 500	2 643 200	2 243 800
Czech Republic					
Bituminous	12 778 000	13 017 000	12 462 000	12 197 000	10 621 000
Lignite	467 000	459 000	437 000	416 000	262 000
Brown coal	48 658 000	48 915 000	49 134 000	47 456 000	45 354 000
Georgia	5 100	8 284	18 891	12 000	...
Germany					
Anthracite & Bituminous	28 018 000	23 762 000	24 185 000	19 143 000	14 971 000
Brown coal	177 907 945	176 324 117	180 409 054	175 313 020	169 857 142
Greece					
Lignite	70 600 000	64 800 000	66 100 000	64 521 000	61 800 000
Hungary					
Lignite	8 153 968	8 467 220	8 351 563	8 041 168	8 027 000
Brown coal	1 426 000	1 431 700	1 450 400	1 386 140	952 000
Kosovo					
Lignite	—	—	—	7 842 000	7 870 727
Macedonia					
Lignite	6 879 726	6 650 182	6 569 220	7 669 103	7 395 915
Montenegro					
Lignite	—	1 502 334	1 195 515	1 740 076	957 164
Norway					
Bituminous (b)	1 667 000	2 359 000	3 223 000	3 429 000	2 437 000
Poland					
Bituminous	97 903 730	95 222 512	88 313 369	84 345 443	78 064 462
Lignite	61 636 445	60 844 278	57 537 727	59 668 166	57 108 304
Romania					
Anthracite & Bituminous	3 079 000	—	—	—	—
Lignite	28 491 480	32 753 526	35 671 000	34 529 000	(c)* 30 000 000
Brown coal	62 609	* 58 000	97 000	205 000	...
Russia	299 000 000	310 000 000	314 000 000	326 000 000	298 000 000
Serbia					
Bituminous	—	65 000	58 000	66 000	69 000
Lignite	—	36 404 000	36 803 000	(c)(d) 31 332 000	(c)(d) 38 828 000
Brown coal	—	316 000	204 000	...	...
Serbia and Montenegro					
Bituminous	65 000	—	—	—	—
Lignite	35 853 000	—	—	—	—
Brown coal	363 000	—	—	—	—
Slovakia					
Lignite	35 000	6 000	20 000	87 000	115 000
Brown coal	2 268 000	2 016 000	1 839 000	2 075 000	2 106 000
Slovenia					
Lignite	3 945 100	3 932 842	4 037 766	4 008 440	3 921 750
Brown coal	594 456	587 912	483 417	488 828	510 769
Spain					
Anthracite	3 888 838	3 775 504	3 485 083	3 152 550	4 060 194
Bituminous	4 664 589	4 572 350	4 387 416	4 085 652	2 891 839
Sub-bituminous	3 354 014	3 221 083	3 128 081	2 890 230	2 453 963
Lignite	7 587 113	6 859 641	6 112 946	—	—
Turkey					
Anthracite	2 785 505	3 070 793	3 230 787	3 343 409	3 773 603
Bituminous	737 701	* ...	...	...	...
Lignite	60 867 574	61 010 000	74 316 728	86 074 626	82 263 104
Ukraine					
Bituminous	78 425 000	80 200 000	75 538 400	77 802 200	(a) 54 977 000
Lignite	313 000	231 000	182 000	289 391	...
United Kingdom					
Bituminous (e)	20 498 000	18 517 000	17 070 000	18 053 000	17 874 000

Production of coal

tonnes (metric)

Country	2005	2006	2007	2008	2009
Botswana	984 876	962 427	828 164	909 511	737 798
Congo, Democratic Republic					
Bituminous	120 000	124 000	128 000	116 000	* 120 000
Egypt	* 300 000	* 300 000	* 360 000	* 360 000	* 360 000
Malawi	51 870	60 408	58 550	* 60 000	* 60 000
Mozambique					
Bituminous	3 417	40 953	23 602	37 700	* 30 000
Niger	182 060	176 320	171 296	182 912	225 072
Nigeria					
Sub-bituminous	* 10 000	* 10 000	* 10 000	* 10 000	* 10 000
South Africa					
Anthracite	1 639 414	1 584 424	2 348 955	2 207 304	1 657 860
Bituminous	242 724 560	243 197 975	245 251 281	250 006 054	248 923 814
Swaziland					
Anthracite	221 701	310 570	241 283	174 807	129 647
Tanzania					
Bituminous	30 795	17 940	27 198	15 242	* 15 000
Zambia					
Bituminous	* 240 000	64 849	14 058	* 14 000	* 14 000
Zimbabwe					
Bituminous	3 370 826	2 107 115	2 080 221	1 509 080	1 667 346
Canada					
Bituminous	30 741 000	29 301 000	32 325 000	32 095 000	27 733 000
Sub-bituminous	25 742 000	26 153 000	26 118 000	25 734 000	24 554 000
Lignite	11 017 000	10 440 000	10 541 000	9 921 000	10 550 000
Mexico					
Bituminous	11 749 126	10 882 685	11 886 757	15 894 060	23 051 869
USA					
Anthracite (f)	1 542 000	1 395 000	1 413 000	1 555 000	1 743 000
Bituminous (f)	518 193 000	509 512 000	482 428 000	507 488 000	449 408 000
Sub-bituminous	430 648 000	467 510 000	475 101 000	487 801 000	458 251 000
Lignite	76 113 000	76 430 000	71 305 900	68 675 000	65 751 000
Argentina					
Bituminous	320 000	295 333	250 000	207 983	181 474
Brazil					
Bituminous & lignite (g)	6 048 105	6 215 258	5 998 354	6 518 733	5 947 364
Chile					
Bituminous	138 056	98 673	184 122	212 375	118 305
Lignite	594 309	575 071	103 871	321 417	517 769
Colombia					
Bituminous	59 675 000	66 192 000	69 902 000	73 502 075	72 807 412
Peru					
Anthracite & Bituminous	29 535	107 091	100 594	136 435	156 372
Venezuela					
Bituminous	7 194 882	7 458 873	8 038 000	* 6 400 000	* 3 640 000
Afghanistan					
Bituminous	…	…	…	314 702	453 592
Bangladesh (l)	87 143	303 016	388 376	602 092	857 000
Bhutan	85 279	97 965	105 261	123 704	48 545
Burma (h)	220 942	351 559	282 655	245 172	233 983
China	2 205 000 000	2 373 000 000	2 536 000 000	2 621 832 300	3 050 000 000
India					
Bituminous (h)	407 039 000	430 832 000	457 082 000	492 945 000	531 966 000
Lignite (h)	30 066 000	31 285 000	33 980 000	32 421 000	34 191 000
Indonesia					
Anthracite & Bituminous	152 722 438	193 761 311	216 930 000	229 000 000	245 000 000
Iran					
Bituminous (i)	1 898 417	2 432 000	2 525 000	2 520 000	* 2 500 000
Japan					
Bituminous	1 146 491	1 341 000	* 1 340 000	* 1 300 000	* 1 300 000
Kazakhstan					
Bituminous	81 869 200	* 91 500 000	94 013 800	106 295 600	86 881 082
Lignite	4 498 500	4 655 100	4 370 100	4 776 700	4 612 000

Production of coal

tonnes (metric)

Country	2005	2006	2007	2008	2009
Korea (Rep. of)					
Anthracite	2 831 658	2 823 990	2 886 000	2 772 544	2 518 940
Korea, Dem. P.R. of (a)	23 500 000	23 000 000	24 100 000	25 060 000	25 000 000
Kyrgyzstan	300 000	300 000	400 000	436 678	546 971
Laos	320 000	319 200	681 700	379 200	466 100
Malaysia	789 356	901 801	1 063 078	1 166 525	2 138 390
Mongolia					
Anthracite & semi-bituminous	...	...	4 664 900	5 228 000	...
Brown coal & lignite	(a) 7 517 100	(a) 8 074 100	4 572 700	4 843 900	(a) 13 163 900
Nepal					
Sub-bituminous (k)	9 259	11 963	16 374	13 845	14 819
Pakistan (j) (l)	3 367 021	3 880 604	3 702 162	4 066 000	* 4 000 000
Philippines					
Bituminous	2 878 625	2 300 341	3 401 136	3 609 316	4 687 277
Tajikistan	94 900	218 000	181 400	198 500	176 100
Thailand					
Lignite	20 878 176	19 070 608	18 239 176	18 095 335	16 360 261
Uzbekistan					
Bituminous	95 040	99 200	* 100 000	* 100 000	* 100 000
Lignite	3 072 960	2 720 000	* 2 700 000	* 3 000 000	* 3 000 000
Vietnam					
Anthracite	34 093 000	38 778 000	42 483 000	39 777 000	43 754 200
Australia					
Bituminous (m)	308 000 000	315 000 000	325 000 000	333 000 000	347 000 000
Brown coal (l)	67 152 000	67 737 000	65 613 000	66 033 000	68 252 000
New Zealand					
Bituminous	2 543 404	2 863 029	2 019 430	2 476 848	2 085 486
Sub-bituminous	2 477 312	2 653 516	2 555 830	2 179 081	2 218 143
Lignite	246 445	251 366	260 148	253 492	259 704
World Total	5 901 000 000	6 189 000 000	6 419 000 000	6 625 000 000	6 938 000 000

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

COBALT

Characteristics

Cobalt is a lustrous, greyish-silver, brittle metal. It is also very hard and can take a high polish. It retains its strength at high temperatures and it has fairly low thermal and electrical conductivities. Cobalt is also ferromagnetic, and therefore is capable of being magnetised. Other properties that are important in industrial applications are its ability to form alloys with many other metals, where it imparts strength, and the ability to maintain its magnetic properties at high temperatures.

A wide range of minerals contain cobalt although many are rare or unique to individual localities. There are approximately 30 principal cobalt-bearing minerals and over a hundred more which contain minor amounts of the metal or include cobalt as a substitute for other elements. Cobalt can substitute for transition metals in many minerals and chemical compounds and is commonly found in the place of iron and nickel as they share many similar properties. Common cobalt-bearing minerals include erythrite ($Co_3(AsO_4)_2.8H_2O$), skutterudite ($(Co,Ni)As_3$), cobaltite (CoAsS) and carrollite ($Cu(Co,Ni)_2S_4$).

Cobalt is almost always extracted as a by- or co-product of mining for other metals, chiefly nickel and copper. Economic concentrations of cobalt can be found in three different geological settings: sediment hosted, for example in the Central African Copperbelt, the world's most important cobalt resource; hydrothermal and volcanogenic, for example at Bou Azzer in Morocco, which hosts the only mine in the world where cobalt is produced as a primary product; and magmatic sulphide and related laterite deposits, for example nickel sulphide bodies in Cuba, New Caledonia, Australia and Russia.

Large quantities of cobalt also occur on the sea floor, contained within manganese nodules and cobalt-rich crusts, although these are not economically viable with current technology and economic conditions.

Uses

As pure metal cobalt has a very limited range of uses, but it is extensively used as an alloying metal. It is valued for its ability to produce very hard superalloys with useful magnetic properties and resistance to high temperatures. Cobalt is used in the manufacture of chemical compounds for a wide range of industrial uses. Rechargeable batteries consume the largest proportion of cobalt in this sector. It is also used as a pigment in glass, enamels, pottery and china. The Cobalt Development Institute (CDI) estimated global end-use of primary cobalt in 2009 to be: batteries 25 per cent, superalloys 20 per cent, hard materials 18 per cent, pigments nine per cent, catalysts 10 per cent, magnets seven per cent and other uses 11 per cent per cent (CDI, 2009).

World production in 2009

Cobalt is mined in 16 countries, mainly as a by-product of copper and nickel mining, and production (of both mined ore and refined metal) doubled in the ten years between 1999 and 2009. According to the CDI, in 2009, 50 per cent of the world's cobalt was extracted as a by-product of nickel mining, 35 per cent from copper and other mining and 15 per cent from primary operations. Morocco is currently the only producer of primary cobalt (from cobalt arsenide minerals). Total world mine production of cobalt in 2009 was approximately 64 000 tonnes (cobalt content of concentrates), two per cent less than in 2008. Over 55 per cent of the world's cobalt ore is mined in the Democratic Republic of Congo (DRC) where 35 500 tonnes were produced in 2009, ten per cent more than in 2008. Canada, Australia and Zambia produce almost another quarter of world production between them, with Zambia becoming the world's second largest producer in 2009 with a 27 per cent production increase. Australian production decreased by eight per cent in 2009, compared to 2008, and Canadian production dropped by 55 per cent due to industrial action and the mothballing of major nickel mines. Due to the availability of new information, production figures for Brazil, which was previously thought to be the third largest producer in the world, have been revised downwards considerably.

Only about 75 per cent of total mine production is recovered as marketable product. Often the rate of cobalt recovery from nickel laterite ore is low and only a fraction of the total is recovered. However, this situation is changing due to advances in heap leaching and other processing technology.

In 2009, total world production of refined cobalt was 59 300 tonnes, a four per cent increase on the 2008 total. Over one third of the world's refined cobalt comes from China, and here production increased by 82 per cent between 2005 and 2009. China has secured many life-of-mine or long-term contracts with cobalt producers in other countries (such as Australia and the DRC) to ship cobalt concentrates to China to ensure sufficient supply to their smelters. Many countries that produce refined cobalt do not mine the cobalt themselves, 23 per cent of refined cobalt production was based on imported material processed by countries that do not mine cobalt ore.

Prices

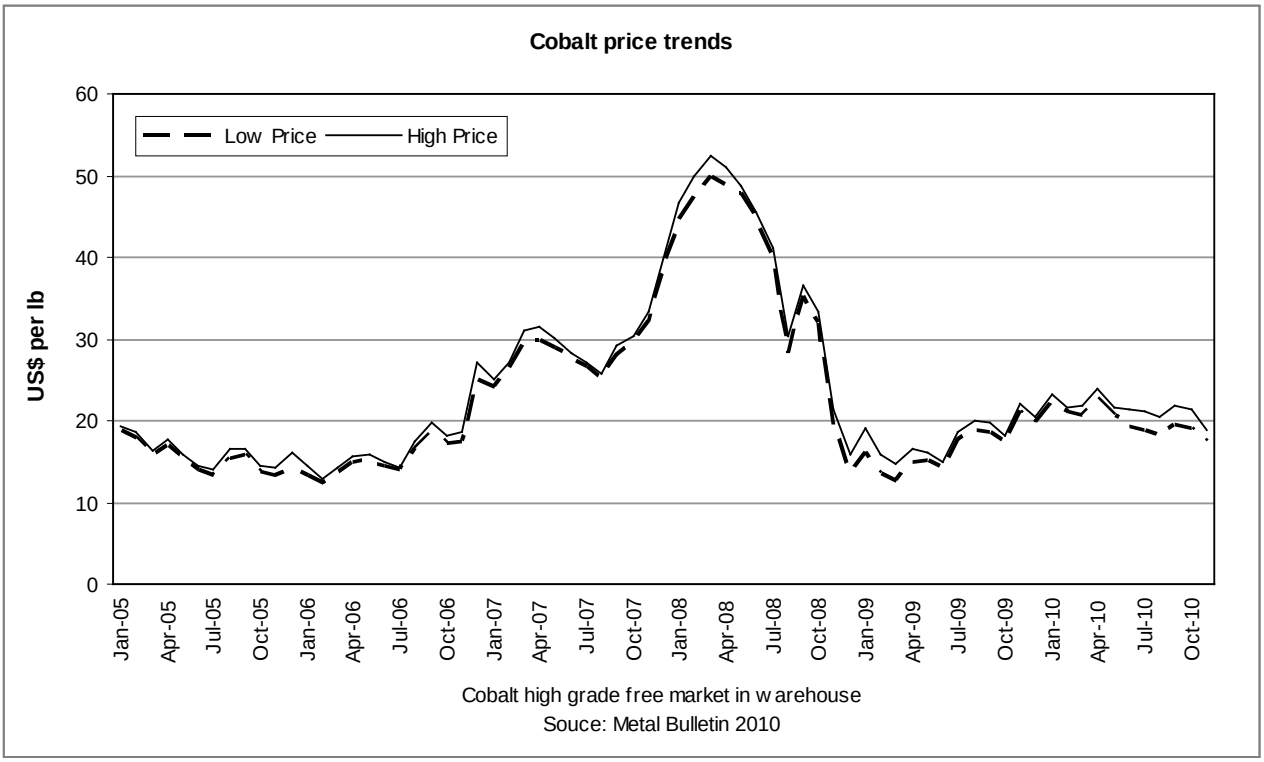
Cobalt prices have long been volatile and during 2007 and 2008 were exceedingly unstable; prices tripled and then fell back to more normal levels within an 18-month period. During 2009 and 2010 the price became more stable compared to 2007 and 2008 but is still variable.

Average prices in 2010 rose by 17 per cent when compared to 2009, driven by high demand. However, the monthly average price for November 2010 was the lowest since October 2009, which demonstrates that prices still remain volatile due to continuing uncertainties in supply and demand.

The price for high grade cobalt peaked at US$24 per pound in April 2010 (Metal Bulletin, 2010a). This was the highest recorded price since the fall in prices which began in October 2008. Cobalt was launched on the London Metal Exchange (LME) in February 2010, but this had surprisingly little effect on the price of the metal and was followed by a period of relatively stable prices. It may be that the global economic crisis has caused market participants to be cautious, but it is hoped the LME trading will stabilise prices.

Throughout 2010 prices hovered around US$21 per pound. Supplies of cobalt ore continue to be strongly controlled by the situation in the DRC, where about half of the new projects due to come on stream within the next few years are located.

Prices of refined cobalt are strongly influenced by demand from the chemical sector and for specialist alloys, particularly for new applications, such as rechargeable batteries, as a catalyst in gas-to-liquid technology and superalloys. These are all sectors that are predicted to grow.



Industry events in 2010

It would seem that the cobalt industry has recovered reasonably well from the recent global economic crisis and the Cobalt Development Institute reported a rise of 18 per cent for the production of cobalt in the first half of 2010 (CDI, 2010). Production increases were seen at several larger operations in 2010 where production difficulties had occurred late in 2009 due to the economic crises. The Chambishi operation in Zambia, the country's largest nickel producer, fully restarted in 2010 following the closure of its furnace from December 2008 to November 2009, and then operated at a reduced capacity for the remainder of 2009 (ENRC, 2010). The Yabulu nickel refinery in north Queensland, Australia, reached full capacity under its new owners, Queensland Nickel, after being sold off by BHP Billiton (Metal Bulletin, 2010b). Sumitomo Metal Mining's Coral Bay HPAL (high pressure acid leach) project in the Philippines also saw production capacity increases; the company aims to reach a capacity of 24 000 tonnes by the end of 2010 (Olchondra, 2010).

Political instability in the Democratic Republic of Congo (DRC) inhibited growth of the cobalt industry in the country. In late 2010 Freeport McMoRan announced that they had reached an agreement with the DRC government for the giant Tenke Fungurume project, which began mining in March 2009. The final contract increased the state-owned mining company's, Gecamines, share of the project from 17.5 per cent to 20 per cent (Kosich, 2010a). First Quantum, which owns several operating mines and projects in the DRC, did not fare so well with government negotiations. At the end of 2009 it was announced that the Kolwezi tailings project was suspended and it was subsequently sealed off by the Ministry of Mines, which claimed that First Quantum had failed to meet its contractual obligations. The operation, designed to extract cobalt from old copper tailings, was to be one of the largest and lowest-cost producers of cobalt in the world, according to First Quantum. During international arbitration proceedings it was announced that the Kolwezi tailings project had been sold by the DRC government to a trading organisation based in Gibraltar, who subsequently sold the project to the global miner ENRC. This sale is being contested by First Quantum (Sergeant, 2010). The DRC government has also transferred the mining licenses from First Quantum's Frontier and Lonshi mines to a separate state owned mining company, Sodimico. First Quantum has initiated a second international arbitration to attempt to regain the rights of these two mines (O'Donovan, 2010).

Many large-scale nickel operations, which are likely to also produce cobalt, continued to progress towards production during 2010. Talvivaara Mining has continued to invest in the Talvivaara Mine in Finland and develop its heap leaching extraction processes. Production ramp up is underway and the company predict that full-scale production will be achievable in 2012 (Talvivaara Mining Company, 2010). Sheritt International continued its development of the Ambatovy nickel-cobalt laterite deposit, which it claims could be the world's largest laterite nickel mine by 2014. The company reports that production is expected to commence in 2011 (Sherrit International Corporation, 2010). Sheritt has also acquired a controlling stake in the Indonesian nickel–cobalt laterite operation at Sulawesi from Rio Tinto; this has now received a permit from the Indonesian government (Mining Journal, 2010). The USA could once again become a cobalt producer with the continued development of the Idaho Cobalt Project by Formation Metals Inc. Construction has begun on the project, which is a primary cobalt resource, and production is planned to begin in 2012 (Formation Metals, 2010). Despite delays during 2009 due to the global economic crisis, Geovic continue to develop its Nkamouna property in Cameroon. The feasibility study on the project is due to be complete by the end of 2010, and laboratory work and financing for the project continue (Geovic Mining Corp, 2010).

In Canada, 2010 continued to be a difficult year for cobalt production with ongoing strikes at the Sudbury and Voisey's Bay nickel mines, which produce large amounts of by-product cobalt. Strikes began mid way through 2009 over pay and conditions. Although the Sudbury strike ended in July 2010

(Kosich, 2010b), the dispute at Voisey's Bay continued. The Newfoundland-Labrador Government has launched an enquiry into why the issues remain unresolved after 17 months of negotiations between Vale Inco, the owners, and the mineworkers' union (Kosich, 2010c).

The trend continues for reductions in global cobalt stockpiles during 2010. Stockpiles held by the USA were reported to be 301 tonnes at June 2009 (Weight, 2010). Russia is also reportedly continuing to reduce its stockpile, but with the rise in the consumption of raw materials and concern over security of supply, a number of nations are reviewing their position on cobalt stockpiling including the USA and EU (Weight, 2010).

Demand remains high for cobalt, especially for battery applications. In 2010, Hitachi announced that it will supply General Motors with lithium ion batteries, which contain significant amounts of cobalt, for hybrid vehicles and that it will raise production from 40 000 units per month to three million units per month. Honda is also planning to produce hybrid electric vehicles reliant on lithium ion batteries (Weight, 2010).

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Mine production of cobalt

tonnes (metal content)

Country	2005	2006	2007	2008	2009
Finland	* 100	* 100	* 120	* 100	* 27
Russia (a)	4 748	4 759	3 587	2 502	2 352
Botswana	326	303	242	337	342
Congo, Democratic Republic	24 500	27 100	25 400	32 300	35 500
Morocco	1 600	* 1 100	1 573	1 791	1 457
South Africa (a)	268	267	307	244	238
Uganda	638	674	698	663	673
Zambia	5 422	4 648	4 229	4 616	5 878
Zimbabwe	304	26	29	28	39
Canada	5 767	7 115	8 692	8 953	4 072
Cuba	4 798	5 602	4 549	3 175	3 500
Brazil	1 400	1 100	1 311	1 215	1 200
China	2 104	1 840	* 2 000	* 2 000	* 2 000
Indonesia	* 650	* 650	* 650	* 650	* 650
Australia (b)	5 198	5 736	5 325	5 770	5 331
New Caledonia	1 769	1 629	1 620	869	719
World Total	60 000	63 000	60 000	65 000	64 000

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 (metric)

Country	2005	2006	2007	2008	2009
Belgium (a)	3 298	2 840	2 825	3 020	2 150
Finland	8 171	8 582	9 173	9 645	8 962
Norway	5 021	4 927	3 939	3 719	3 510
Russia	4 748	4 759	3 587	2 502	2 352
Congo, Democratic Republic (b)	600	550	608	1 049	2 950
Morocco	1 613	1 405	1 573	1 791	1 457
South Africa (c)	268	267	307	244	238
Uganda	638	689	636	662	673
Zambia	5 422	4 665	4 435	3 841	1 535
Canada (d)	5 090	5 180	5 620	5 637	4 918
Brazil	1 136	902	1 148	994	1 012
China (a)	* 12 700	* 12 700	13 245	18 239	23 138
India	1 220	1 184	980	858	1 001
Japan	471	920	1 085	1 071	1 332
Australia	3 150	3 696	3 684	3 617	4 050
World Total	53 500	53 300	52 800	56 900	59 300

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

Mine production of copper

tonnes (metal content)

Country	2005	2006	2007	2008	2009
Albania	1 696	1 140	2 980	2 980	2 788
Armenia	16 400	17 800	17 400	18 540	22 968
Bulgaria	112 536	123 571	116 157	107 195	110 652
Cyprus	—	900	2 900	3 000	2 500
Finland	15 000	13 000	13 600	13 300	14 600
Georgia	* 9 500	14 600	11 000	18 700	16 600
Macedonia	4 799	7 054	7 029	8 051	7 440
Poland	511 799	497 200	451 900	429 687	439 000
Portugal	89 541	78 576	90 182	89 026	86 462
Romania	16 286	12 535	2 213	308	1 200
Russia	640 000	675 000	690 000	705 000	675 700
Serbia	—	11 100	16 500	17 600	19 400
Serbia and Montenegro	11 600	—	—	—	—
Spain	7 358	8 700	6 281	7 071	17 663
Sweden	87 068	86 746	62 905	57 688	55 414
Turkey	54 100	46 400	81 400	83 000	87 070
Botswana	26 704	24 255	19 996	23 146	24 382
Congo, Democratic Republic	97 500	142 300	148 400	242 900	293 000
Mauritania	...	5 031	28 755	33 073	36 608
Morocco	3 200	4 600	4 774	5 055	8 486
Namibia	10 157	6 262	5 800	8 800	—
South Africa	88 600	89 500	97 000	108 700	107 600
Tanzania	3 661	3 285	3 276	2 852	2 019
Zambia	465 002	515 618	524 000	567 700	601 200
Zimbabwe	2 570	2 581	2 681	2 827	3 572
Canada	595 383	603 295	596 249	607 957	494 524
Mexico	429 042	334 129	337 527	246 593	240 648
USA	1 140 000	1 197 000	1 169 000	1 307 900	1 204 000
Argentina	187 317	180 144	180 223	156 900	143 084
Bolivia	35	218	606	567	620
Brazil	133 325	147 836	205 728	222 000	217 000
Chile	5 320 500	5 360 800	5 557 000	5 327 600	5 389 600
Colombia	1 800	600	840	1 050	1 140
Peru	1 009 898	1 048 472	1 190 274	1 267 867	1 274 725
Burma	34 500	19 500	15 100	6 900	9 800
China	776 000	889 000	946 200	1 092 700	1 029 000
India (a)	28 640	30 051	47 190	29 996	* 26 500
Indonesia	1 063 849	817 796	796 899	655 046	988 530
Iran	149 900	216 200	244 200	248 100	262 500
Japan	* 1 000	* 300	—	—	—
Kazakhstan	401 700	446 300	406 500	421 700	* 400 000
Korea, Dem. P.R. of	* 12 000	* 12 000	* 12 000	* 12 000	* 12 000
Laos	30 480	60 803	62 541	89 004	121 581
Mongolia	126 560	129 675	130 165	126 980	129 800
Oman	—	—	9 100	16 800	15 000
Pakistan	17 700	18 700	18 800	18 700	19 600
Philippines	16 320	17 161	22 862	21 235	49 060
Saudi Arabia	668	730	737	1 465	1 700
Uzbekistan	* 80 000	* 80 000	* 80 000	* 80 000	* 80 000
Vietnam	3 100	11 400	12 500	11 000	* 12 000
Australia	935 000	878 000	871 000	886 000	854 000
Papua New Guinea	192 978	194 355	169 184	159 650	166 669
World Total	15 000 000	15 100 000	15 500 000	15 600 000	15 800 000

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

Smelter production of copper

tonnes (metric)

Country	2005	2006	2007	2008	2009
Armenia	9 881	8 791	6 954	6 480	6 858
Bulgaria	225 000	217 000	217 600	257 100	256 200
Finland	157 933	164 306	118 911	142 154	110 479
Germany	257 200	273 800	270 200	295 000	251 000
Norway	38 681	39 700	34 200	37 000	33 900
Poland	555 681	555 907	518 303	492 942	457 510
Russia	695 500	635 000	650 000	627 000	579 600
Serbia	—	40 000	30 200	31 900	32 000
Serbia and Montenegro	30 000	—	—	—	—
Spain	284 215	263 662	257 348	259 897	264 971
Sweden	168 763	129 951	148 835	136 409	125 398
Turkey	27 700	26 300	17 900	38 000	—
Botswana	28 100	29 700	27 000	25 000	24 700
Congo, Democratic Republic (a)	10 000	10 000	1 800	—	—
Namibia	21 699	21 918	20 600	16 600	21 500
South Africa	105 500	98 900	111 900	94 800	86 900
Zambia (a)	244 800	289 700	224 000	232 000	334 000
Canada	441 325	484 675	470 713	443 710	316 510
Mexico	340 462	298 526	294 746	230 056	178 672
USA	523 000	501 300	617 300	573 800	597 400
Brazil	199 043	219 684	218 000	227 800	208 400
Chile	1 558 100	1 565 400	1 514 300	1 369 200	1 522 300
Peru	321 968	322 188	236 809	306 583	325 788
China	1 751 500	1 917 500	2 111 500	2 453 400	2 648 300
India	482 300	609 600	699 900	651 000	705 100
Indonesia	275 000	201 200	277 100	261 300	295 900
Iran	170 200	177 500	180 300	179 800	192 700
Japan	1 266 432	1 361 771	1 383 372	1 335 846	1 302 120
Kazakhstan	404 817	424 784	392 834	392 575	* 380 000
Korea (Rep. of)	436 600	449 200	470 000	502 000	455 400
Korea, Dem. P.R. of	* 10 000	* 10 000	* 10 000	* 10 000	* 10 000
Oman	24 500	20 710	13 940	11 906	11 830
Pakistan	18 600	23 600	18 200	17 800	18 300
Philippines	201 300	239 600	219 900	239 700	230 100
Thailand	28 600	1 000	5 600	—	—
Uzbekistan	115 000	93 000	90 200	90 100	90 000
Vietnam	—	—	—	2 200	6 000
Australia	410 000	377 000	399 000	449 000	422 000
World Total	11 800 000	12 100 000	12 300 000	12 400 000	12 500 000

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

Production of refined copper

tonnes (metric)

Country	2005	2006	2007	2008	2009
Austria	72 300	72 600	81 400	106 700	96 200
Belgium	382 900	378 600	394 000	395 800	373 700
Bulgaria	60 500	65 500	69 900	126 700	196 900
Cyprus	—	880	3 012	2 986	2 380
Finland	132 126	137 961	109 870	131 249	105 549
Germany	638 800	662 338	665 517	689 763	668 945
Italy	32 200	36 400	28 600	24 200	6 500
Norway	38 681	39 700	34 200	37 000	33 900
Poland	560 256	556 625	532 975	526 808	502 491
Romania	20 739	21 583	18 589	15 300	14 500
Russia	934 900	951 400	949 000	862 000	874 000
Serbia	—	41 400	31 600	33 800	27 400
Serbia and Montenegro	31 300	—	—	—	—
Spain	313 105	299 146	308 372	319 050	329 356
Sweden	223 482	229 241	213 894	227 774	205 759
Turkey	94 900	105 800	99 600	88 000	33 500
Ukraine	13 600	17 300	19 500	21 700	20 000
Congo, Democratic Republic	20 000	24 200	36 000	61 200	158 400
Egypt (a)	* 1 500	* 1 500	1 719	2 664	2 842
South Africa	98 600	100 300	110 700	92 700	88 600
Zambia	445 600	497 200	523 400	575 000	697 859
Zimbabwe	6 000	6 700	6 000	3 100	* 3 000
Canada	515 223	500 463	453 453	442 050	335 896
Mexico	377 500	303 626	329 746	265 056	213 672
USA	1 255 000	1 250 300	1 310 800	1 280 300	1 161 200
Argentina	* 16 000	* 16 000	* 16 000	* 16 000	* 16 000
Brazil	199 043	219 684	218 000	227 800	208 400
Chile	2 824 000	2 811 300	2 936 500	3 057 600	3 271 800
Peru	510 392	507 710	413 907	463 933	423 393
Burma	34 500	19 500	15 100	6 900	9 800
China	2 606 800	3 002 100	3 499 400	3 794 600	4 109 500
India (b)	529 248	510 623	501 485	502 081	* 500 000
Indonesia	262 900	217 600	256 900	253 400	284 800
Iran	178 000	200 900	204 300	210 000	200 000
Japan	1 395 284	1 532 055	1 576 818	1 539 957	1 439 843
Kazakhstan	418 865	429 729	408 026	400 270	368 100
Korea (Rep. of)	526 563	561 500	566 400	537 925	531 701
Korea, Dem. P.R. of	* 15 000	* 15 000	* 15 000	* 12 000	* 12 000
Laos	30 480	60 803	62 541	64 075	67 562
Mongolia	2 475	2 618	3 007	2 587	2 470
Oman	24 500	20 710	13 940	11 906	11 830
Philippines	172 000	181 000	160 200	174 600	178 000
Thailand	26 100	27 050	12 714	438	490
Uzbekistan	115 000	92 800	89 600	70 400	82 500
Vietnam	—	—	—	2 200	6 000
Australia	469 000	429 000	442 000	503 000	446 000
World Total	16 600 000	17 200 000	17 700 000	18 200 000	18 300 000

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 30 June of that stated

(b) Years ended 31 March following that stated

Production of diamond

Carats

Country	2005	2006	2007	2008	2009
Russia	38 000 990	38 360 810	38 291 200	36 925 150	34 759 400
Angola	7 079 121	9 175 061	9 701 709	8 906 974	13 827 609
Botswana	31 889 771	34 293 401	33 639 000	32 595 000	17 734 000
Cameroon (a)	* 12 000	* 12 000	* 12 000	* 12 000	* 12 000
Central African Republic	382 756	419 528	467 711	372 754	310 469
Congo	...	...	22 000	110 000	68 000
Congo, Democratic Republic	33 054 998	28 990 241	28 452 496	33 401 928	21 298 459
Ghana	1 065 923	959 405	839 235	598 042	354 443
Guinea	548 522	473 862	1 018 723	3 098 490	696 732
Ivory Coast	* 300 000	* 300 000	* 300 000	* 300 000	* 300 000
Lesotho	52 036	231 325	229 077	253 054	91 816
Liberia	11 000	11 000	21 699	46 963	36 828
Namibia	1 902 484	2 356 285	2 266 100	2 435 195	1 191 762
Sierra Leone	668 807	582 324	603 698	371 290	400 480
South Africa	15 775 720	15 152 801	15 247 122	12 901 018	6 118 974
Tanzania	219 640	272 204	282 786	237 676	181 874
Togo	11 773	25 368	13 452	8 787	12 540
Zimbabwe	243 928	1 046 025	695 016	797 198	963 502
Canada	12 314 000	13 233 813	17 007 850	14 802 699	10 946 098
Brazil	207 836	181 350	182 031	80 226	21 153
Guyana	356 948	340 544	268 925	168 926	143 982
Venezuela	55 154	27 598	14 502	9 381	...
China	* 1 060 000	* 1 065 000	* 1 070 000	* 1 070 000	* 1 050 000
India (b)	44 170	2 180	586	536	16 810
Indonesia	21 606	46 856	22 980	27 688	—
Australia	30 678 000	29 308 000	19 231 000	15 670 000	10 795 000
World Total	176 000 000	176 900 000	169 900 000	165 200 000	121 300 000

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

Production of diatomite

tonnes (metric)

Country	2005	2006	2007	2008	2009
Commonwealth of Independent States (b)	* 80 000	* 80 000	* 80 000	* 80 000	* 80 000
Czech Republic	4 100	4 827	3 600	4 100	3 100
Denmark					
Moler (a)	209 000	196 000	201 000	210 000	168 000
France	* 75 000	* 75 000	* 75 000	* 75 000	* 75 000
Hungary	2 190	495	1 424	—	1 277
Poland	500	600	* 600	600	670
Romania	1 402	1 719	2 057	—	—
Spain (c)	39 101	52 123	45 480	46 192	* 45 000
Algeria	1 814	1 800	1 902	1 677	1 847
Ethiopia (d)	420	—	—	—	4 104
Kenya	243	185	201	72	231
Mozambique	...	...	651	379	* 400
Costa Rica	27 000	26 000	25 000	24 000	24 500
Mexico	62 132	62 948	82 519	128 536	80 807
USA (e)	653 000	799 000	687 000	764 000	* 790 000
Argentina	34 045	38 543	49 604	36 996	62 270
Brazil	7 670	8 968	9 600	12 100	* 12 000
Chile	27 091	19 104	25 405	25 497	23 027
Colombia	* 4 000	* 4 000	* 4 000	* 4 000	* 4 000
Peru	* 35 000	* 35 000	21 603	12 200	9 946
China	400 000	* 420 000	* 420 000	* 440 000	* 440 000
Iran (f)	1 450	13 400	300	2 000	* 2 000
Japan	130 005	* 130 000	* 120 000	* 115 000	* 115 000
Korea (Rep. of)	2 193	3 460	2 360	2 540	2 440
Saudi Arabia	* 1 000	* 1 000	* 1 000	* 1 000	* 1 000
Thailand	990	1 344	1 260	4 075	* 4 000
Vietnam	* 10 000	* 10 000	* 10 000	* 10 000	* 10 000
Australia (g)	33 827	* 34 000	* 34 000	* 33 000	* 33 000
World Total	1 843 000	2 020 000	1 906 000	2 033 000	1 994 000

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

(a) Moler is an impure diatomite containing a large proportion of clay
(b) Diatomite is produced in Armenia, Georgia and Russia but information is not available to provide estimates for individual countries
(c) Including Tripoli
(d) Years ended 7 July of that stated
(e) Sold or used by producers
(f) Years ended 20 March following that stated
(g) Years ended 30 June of that stated

Production of feldspar

tonnes (metric)

Country	2005	2006	2007	2008	2009
Bulgaria	72 867	93 091	* 90 000	* 90 000	* 90 000
Czech Republic	472 000	487 000	514 000	488 000	431 000
Finland	42 783	43 187	48 980	45 250	* 45 000
France	651 000	* 650 000	* 650 000	* 650 000	* 550 000
Germany	168 640	167 332	171 303	161 416	* 150 000
Greece	100 586	* 100 000	95 000	62 000	28 617
Italy	3 995 233	4 600 903	3 524 389	* 5 000 000	* 5 000 000
Macedonia	27 076	38 124	32 814	28 920	19 377
Norway	* 67 000	65 000	65 000	62 000	48 000

Production of feldspar

tonnes (metric)

Country	2005	2006	2007	2008	2009
Poland	490 200	457 400	501 800	599 100	445 500
Portugal	238 843	257 570	371 952	* 370 000	* 370 000
Romania	74 927	33 100	41 477	22 995	* 20 000
Russia	* 160 000	* 160 000	* 160 000	* 160 000	* 160 000
Serbia	—	* 3 500	* 3 500	* 3 500	* 3 500
Serbia and Montenegro	* 3 500	—	—	—	—
Slovakia	3 000	3 000	—	10 000	13 000
Spain	650 061	696 912	683 134	690 256	* 550 000
Sweden	30 000	24 000	25 000	22 000	18 000
Turkey	4 750 000	5 500 000	6 000 000	6 500 000	4 000 000
Ukraine	63 930	67 313	76 305	83 420	84 757
United Kingdom (a)	(e) 1 835	(e) 1 441	(e) 1 112	430	* 400
Algeria	43 872	65 615	83 208	115 938	131 046
Egypt	357 134	* 360 000	135 290	168 673	...
Ethiopia	544	500	566	523	199
Morocco	* 31 000	* 34 000	37 955	30 080	* 30 000
Nigeria	269	1 021	...	...	13 631
South Africa	56 574	76 722	90 312	105 815	101 394
Cuba	8 020	5 500	5 600	4 300	4 700
Guatemala	3 808	17 176	10 480	45 854	5 672
Mexico	373 411	459 209	438 696	445 519	347 510
USA	750 000	760 000	730 000	680 000	* 530 000
Argentina	151 307	170 728	291 562	220 234	213 671
Brazil	196 419	166 418	166 000	122 000	* 120 000
Chile	5 820	5 847	6 704	17 834	9 079
Colombia	* 100 000	* 100 000	* 100 000	* 100 000	* 100 000
Ecuador	38 249	67 844	14 307	* 14 000	* 14 000
Peru	9 038	9 287	15 450	13 333	5 006
Uruguay	2 150	2 470	2 050	1 920	* 2 000
Venezuela	202 000	* 200 000	* 200 000	* 200 000	* 200 000
China	2 300 000	* 2 350 000	* 2 400 000	* 2 400 000	* 2 400 000
India (b)	426 498	479 715	488 458	351 095	390 074
Indonesia	* 24 000	* 25 000	* 25 000	* 26 000	* 26 000
Iran (c)	286 033	411 807	512 261	501 821	* 502 000
Japan (a)	* 800 000	* 800 000	* 750 000	* 700 000	* 700 000
Jordan	1 000	11 054	9 800	2 950	—
Korea (Rep. of)	508 644	427 378	398 513	344 257	622 770
Malaysia	117 180	142 358	358 585	457 377	356 620
Pakistan (d)	25 032	22 435	26 120	19 000	* 19 000
Philippines	11 853	15 176	14 837	15 838	16 394
Saudi Arabia	42 587	46 700	73 000	55 000	* 55 000
Sri Lanka	45 492	56 864	46 583	55 212	73 365
Taiwan	—	—	—	4 379	—
Thailand	1 149 717	1 067 684	684 668	670 618	* 670 000
Uzbekistan	* 4 300	* 4 300	* 4 300	* 4 300	* 4 300
Vietnam	* 200 000	* 200 000	* 200 000	* 200 000	* 200 000
Australia (d)	95 362	* 100 000	* 105 000	* 102 000	* 100 000
World Total	20 431 000	22 112 000	21 481 000	23 245 000	20 171 000

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

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

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. Broadly there are two sources for fluorspar mineralisation. Most commonly fluorspar is deposited by hydrothermal solutions sourced from igneous intrusions or deep digenetic processes. Here mineralisation occurs as vein or replacement deposits, either by the filling of cavities and fissures or by the replacement of the host rock, typically carbonate rocks. Economic deposits of fluorspar are also found as accessory minerals in igneous rocks, where deposits are either associated with pegmatitic granites or in carbonatite and alkaline rock complexes.

World reserves of fluorspar (measured as pure CaF_2) are 230 million tonnes, of which South Africa holds 41 million tonnes, Mexico 32 million tonnes and China 21 million tonnes (Miller, 2010).

Uses

The grade of fluorspar determines its end-use. Approximately a third 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. The majority of fluorspar produced, around 65 per cent, 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 has rapidly declined in recent years due to concern over the effect of the chlorine component in depleting the ozone layer. 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. Fluoropolymers 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 2009

World production of fluorspar decreased by three per cent in 2009 compared to 2008. This is the first decrease in annual production since 2003 and was caused by a decrease in demand due to the global financial crisis. The steady growth in fluorspar production between 2003 and 2008 was driven, for the most part, by increased Chinese consumption, although decreases in European and Russian production in 2007 meant a more modest rise in world production.

China continued its dominance of world fluorspar production with 55 per cent of total world production, although production decreased by 1.5 per cent from 2008–2009; over the last five years output has increased by 18.5 per cent. The world's second largest producer, Mexico, showed a small production decrease in 2009 compared to 2008, although production has risen by 19.5 per cent between 2005 and 2009. Mongolia, the world's third largest producer, significantly increased its production in 2009 by 37 per cent. In part, this was due to the completion of an extensive modernisation project at the Bor-Undur mineral processing plant (Roberts, 2010).

European production decreased in 2009 compared to 2008 with the largest producers, Russia and Spain, decreasing output by 22 and 18 per cent respectively. Europe's only other producers, since production finished in France and Italy in 2006, are Germany and the United Kingdom. In Germany, production increased by three per cent in 2009 compared to 2008, but in the UK production fell by almost 50 per cent.

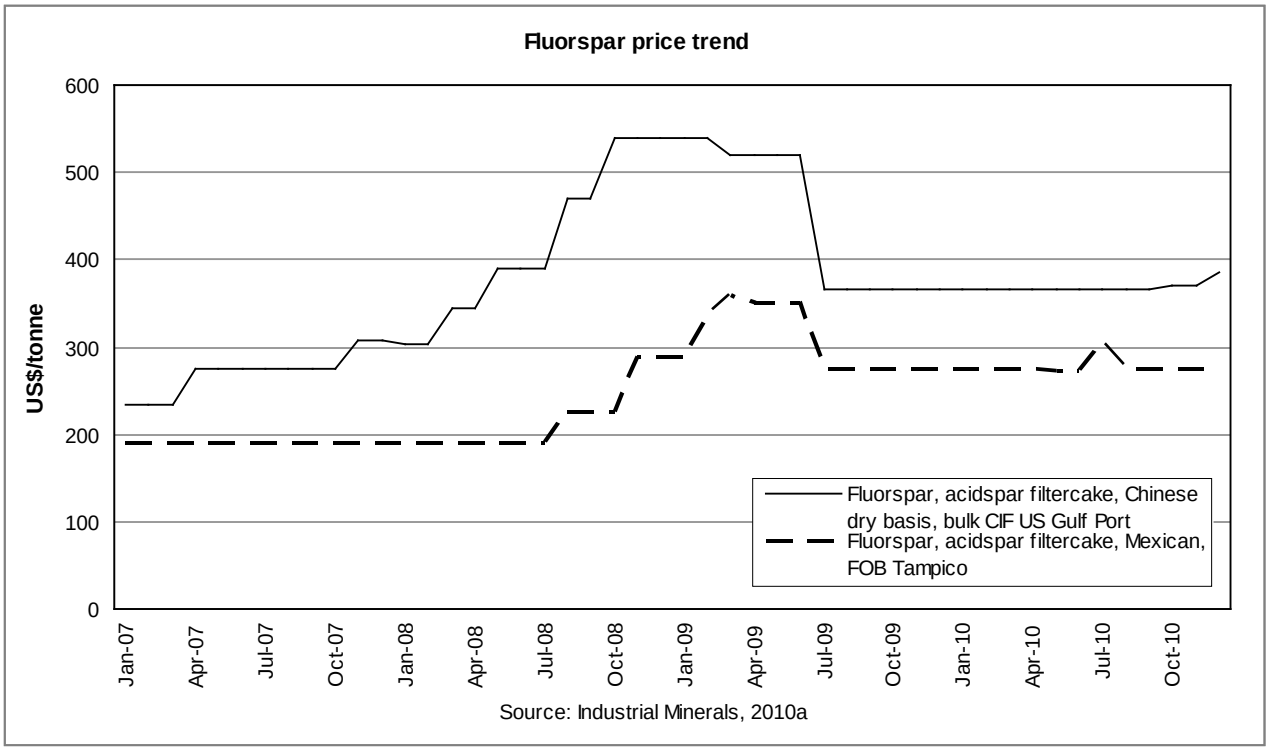
Prices

The majority of fluorspar is traded on an annual contract basis and only small amounts are openly traded on the open market. During 2010, fluorspar prices in all grades remained constant, with only small fluctuations in price. Despite a rapid decrease in prices during mid 2009 due to a weakened demand from the fluorochemical sector, prices still remained higher than in 2007, before the unprecedented peaks seen in 2008 and 2009. This was probably due to constant demand, mainly from the emerging economies, and decreasing supply from China. The price of Mexican acidspar filtercake (f.o.b. Tampico), finished 2010 at US$260–US$290 per tonne, and Chinese acidspar filtercake (c.i.f. US Gulf Port) was priced at US$370–US$400 per tonne in December 2010 (Industrial Minerals, 2010a).

Industry events in 2010

During 2010 fluorspar was highlighted as one of 14 critical raw materials to the EU in a report compiled following the European Commission's Raw Material Initiative. This emphasised the mineral's importance in modern technologies and the potential difficulties with future supply (EC, 2010).

The Chinese fluorspar industry has again dominated world industry events during 2010; China has continued to impose export quotas, duties, extra licensing and price requirements on fluorspar to restrict its exports leading the USA to request World Trade Organisation (WTO) dispute settlement consultations with China in June 2010. If the WTO finds that China has breached its rules it will be forced to modify its export policy or face retaliations from other major fluorspar produces and consumers, e.g. the USA, Mexico and Europe (Industrial minerals, 2010b). Despite the planned phase out of environmentally damaging chlorofluorocarbons under both the Montreal and Kyoto Protocols, production of fluorocarbons is still high due to a thriving refrigerant industry in China, India and other developing countries that have longer to comply with the commitments under the Protocol than developed countries.



Despite the collapse in prices seen in mid 2009, fluorspar is currently a growth area in mining due to a strong demand for the mineral, and many new projects are being planned. In Africa, Sephaku Holdings Ltd continued to develop its Nokeng mine and associated processing facilities which, upon completion, would be South Africa's first acidspar benefaction plant (Sephaku Holdings, 2010). Sallies also raised production from a very poor 2009 after the closure of its Buffalo mine and mothballing of the low grade Witkop mine. Sallies reopened the Witkop site for a bulk order for 5500 wet tonnes of acid grade fluorspar; this deposit is now more attractive due to a strong rand and higher fluorspar prices (Industrial minerals, 2010c). Also in South Africa, a scoping study was completed on the Doornhoek fluorspar project, previously owned by CAMEC plc, which was taken over by ENRC, early in 2010 (CAMEC, 2009).

The Australian company, Minemakers, continued to develop its Moina Project in Tasmania and is evaluating test work from a drilling programme, completed at the end of 2009, and a metallurgical programme (Minemakers Limited, 2010).

There was some interest in European fluorspar deposits from UK-based exploration company, Tertiary Minerals, who have been developing the Storuman fluorspar deposit in Northern Sweden. A scoping study was completed in July 2010 that revealed the mine could run for 23 years and produce 103 000 tonnes of acidspar annually. Tertiary Minerals has also purchased mining rights for a second fluorspar deposit in Norway. The Lassedalen deposit is estimated to contain 1.2 million tonnes of fluorspar at both acidspar and metspar grades (Tertiary Minerals plc, 2010).

North America has also seen investment in fluorspar projects, Mexican producer Flourita de Mexico Sa de CV plan to increase its capacity by 30 per cent following development of around 30 square kilometres of new concessions near Monterrey; this could boost its capacity from 140 000 to 180 000 tonnes per year (Roberts, 2010). In the USA, Hastie Mining and Moodie Mineral Co have completed a drilling programme on the Klondike II fluorspar project in Livingston County, Kentucky. This has revealed resources exceeding one million tonnes of acidspar. If developed this could see the USA once again producing primary fluorspar (Roberts, 2010). The St Lawrence fluorspar mine in Canada, which was closed in 1990, continued to be developed during 2010 by Canada Fluorspar Inc which is working towards reactivating the underground workings. The company plans to construct new tailings facilities and a new marine terminal for the project, which is anticipated to produce between 120 000 and 180 000 tonnes of acid grade fluorspar filtercake per year (Canada Fluorspar Inc, 2010).

Mongolia, the world's third largest producer, also continued to attract interest in fluorspar from London-based Lotus resources. Lotus acquired a mining licence for the Tsagaan Chuluut project in Dornogobi Province. This deposit is reported to be similar to Mongolia's largest fluorspar producer, the Bor-Undor mine (Kosich, 2010).

A significant industry development was the announcement of the Ineos Group to sell Ineos Fluor to Mexican fluorspar producer, Mexichem Fluor SA, in a deal worth US$350 million. Included in the sale were all Ineos Fluor operations in North America, Europe and Asia. However, Ineos retained ownership of its UK fluorspar mining subsidiary, Glebe Mines Ltd (Roberts, 2010). However, in December 2010 Glebe announced it would cease mining and processing by the end of 2010 due to a failure to secure future funding for the plant, thus ending the UK's fluorspar production (Industrial Minerals, 2010d).

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Production of fluorspar

tonnes (metric)

Country	2005	2006	2007	2008	2009
France	53 000	* 40 000	—	—	—
Germany	35 364	53 009	54 359	48 519	49 962
Italy	70 326	* 15 000	—	—	—
Russia	245 500	* 210 000	* 180 000	* 269 000	* 210 000
Spain	144 126	144 845	155 197	148 736	122 408
United Kingdom	56 417	49 676	44 936	36 801	18 536
Egypt	549	* 550	* 500	470	* 500
Kenya (a)	109 594	132 030	85 115	130 100	5 500
Morocco	114 700	103 300	78 817	56 724	66 000
Namibia	114 886	132 249	118 766	118 263	* 118 000
South Africa	265 600	256 000	285 000	299 000	* 180 000
Mexico	875 450	936 433	933 361	1 057 649	1 045 940
Argentina	7 502	8 278	9 735	15 098	13 424
Brazil (b)	66 512	63 604	65 526	63 573	* 60 000
China	2 700 000	3 000 000	3 200 000	3 250 000	3 200 000
India (c)	5 577	2 053	3 970	2 524	3 880
Iran (d)	64 601	58 871	68 192	61 592	* 62 000
Kazakhstan	4 750	* 30 000	64 000	66 300	* 66 000
Korea, Dem. P.R. of	* 12 500	* 12 500	* 12 500	* 12 500	* 12 500
Kyrgyzstan	* 4 000	* 4 000	* 4 000	* 4 000	* 4 000
Mongolia	327 100	347 700	354 900	334 800	459 500
Pakistan (e)	* 1 040	2 839	1 551	* 1 400	* 1 400
Thailand	295	3 240	1 820	29 529	119 840
Vietnam	* 4 000	* 4 000	* 4 000	* 4 000	* 4 000
World Total	5 300 000	5 600 000	5 700 000	6 000 000	5 800 000

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): 2005: 86; 2006: 70; 2007: 83; 2008: 92; 2009: 97

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

Production of germanium metal

tonnes (metric)

Country	2005	2006	2007	2008	2009
USA (a)	5	5	5	5	5
China	* 35	* 100	* 100	* 100	* 100
Japan	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 and most reagents. Gold occurs in its native state or in combination with other elements such as silver.

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 57 per cent of total demand in the third quarter of 2010, followed by investment demand (30 per cent) and industrial and dental demand (12 per cent) (World Gold Council, 2010). 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 medicine. Research is continually finding new applications for gold including catalysts and in nanotechnology.

World production in 2009

Gold production is recorded in more than 90 countries; several more countries also produce substantial quantities of gold, from small operations, that are not recorded in official statistics. Seven countries (China, USA, Australia, Russia, South Africa, Peru and Indonesia) produce more than a 100 000 kilograms (metal content) of gold annually, or 60 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 2009 was 2460 tonnes, an increase of 170 tonnes since 2008, when it was at its lowest level for 12 years. Following a 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. Exploration expenditure for gold in 2010 accounted for almost half of the total global non-ferrous metals expenditure budget (Gold Exploration, 2010).

Despite dominating world gold production for many decades, output from South Africa has been declining in recent years 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 per cent fall in gold production from 213 tonnes in 2008 to 198 tonnes in 2009 (a 33 per cent decline since 2005), largely attributed to safety problems and significant power and skills shortages in the country. This places South Africa fifth amongst the world's largest gold producing countries. In 2007 China became the world's largest gold producer, as a result of dramatic increases in production in recent years. The Chinese Government has been highly supportive of gold exploration leading to a rapidly expanding resource base. China's output reached 320 tonnes in 2009, a 12 per cent increase on the previous year and a 25 per cent increase since 2005.

Other traditionally dominant gold producers, including Australia, USA and Canada, are rapidly losing ground to new producers. US gold output has declined by 13 per cent over the last five years, Canadian output by 19 per cent and Australian output by 16 per cent. In recent years 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. Notably, Indonesian production fell by more than 53 tonnes in 2008 to 64 tonnes; largely as a result of lower ore grades at Grasberg. Production recovered to 128 tonnes in 2009 as a result of Grasberg mining a section in the open pit with lower copper but higher gold ore grades. Peru, which is now the world's sixth 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. Russian gold production increased by 11 percent in 2009. In addition to primary production, recycling is a significant source of gold. The World Gold Council reports that during the third quarter of 2010, the supply of recycled gold increased by 41 per cent year-on-year, while mine supply only grew by 3 per cent (World Gold Council, 2010).

Prices

The gold market is characterised by substantial above-ground reserves, held mainly by banks. If some of these reserves are released into the world market the gold price may be significantly affected. The gold price can be volatile but has strengthened considerably 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 (2011).

In 2009, the gold price averaged US$970 per troy ounce, an 11 per cent increase on 2008, having reached an all-time high of more than US$1200 per troy ounce in early December 2009.

During the March quarter of 2010 the gold price remained largely unchanged, averaging US$1110 per troy ounce and rising less than one per cent, compared with the December quarter 2009. However, during April and May prices began to increase, reaching US$1238 per troy ounce in mid May. The principal drivers were investor concerns regarding the fiscal positions of several European Countries, including Greece, Spain, Portugal and Italy and increased uncertainty surrounding the outlook for world economic growth. Associated instability in the currency markets and increasing volatility in the prices of other assets such as equities and other commodities resulted in the increased demand for gold, viewed as a low risk asset (Schultz, 2010).

Gold prices increased steadily during June, exceeding US$1260 per troy ounce by the end of the month, as a result of a weakening US dollar, continuing fears about global economic recovery and speculation that China would allow the Yuan to strengthen (Mineweb, 2010a). Prices fluctuated, but declined slightly during July, averaging US$1140 per troy ounce. Gold prices increased during August over increasing fears about economic recovery, in response to reports of declining industrial output in China and Europe (Metal Markets, 2010a). By mid September gold prices were trading at US$1270 per troy ounce as investors sought a safe haven, as

the US dollar weakened and there was increased reluctance to invest in equity markets (Metal Markets, 2010b). The gold price continued to increase reaching US$1360 per troy ounce in mid October, in response to a weakening US dollar, a decline in equity markets and news of increased US unemployment (Metal Markets, 2010c). The gold price fell slightly towards the end of October as a result of Chinese interest rate cuts and a strengthening US dollar (Metal Markets, 2010d).

Prices recovered during early November, as investors awaited the outcome of elections in the US and the US dollar weakened. Concerns regarding US inflation and renewed worries about the European debt crisis pushed the gold price to a new record high of US$1421 per troy ounce (Metal Markets, 2010e,f). Subsequently the gold price decreased to below US$1400 per troy ounce on news that Chinese interest rates may rise, strengthening of the US dollar and European debt concerns (Metal Markets, 2010g,h). The gold price had strengthened by the end of November, returning to US$1420 per troy ounce in early December, in response to news of increased US unemployment and continued concerns regarding debt problems in some European countries (Metal Markets, 2010i,j). The gold price finished the year above US$1400 per troy ounce as the US dollar weakened, concerns regarding the Eurozone economy persisted, particularly in Ireland and Spain, amid the threat of rising inflation as central banks continue to increase money supplies (Metal Markets, 2010k). The average gold price during 2010 was US$1220 per troy ounce, a 26 per cent increase on 2009.

Industry events in 2010

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 continued during 2010 as miners tried to take advantage of soaring gold prices. It is estimated that gold producers reduced their gold hedge books by an estimated 61 per cent last year, or 145 tonnes of gold. The reduction left the global outstanding hedge book at 2.93 million troy ounces at the end of 2010 (Campbell, 2011). The major de-hedger during 2010 was AngloGold Ashanti Ltd, which completely eliminated its hedge book in October, enabling the company to sell at market prices. This amounted to about 95 tonnes at the end of the second quarter 2010 (World Gold Council, 2010).

Central banks have traditionally been sellers of gold. However, there is evidence that central banks are building up their gold reserves, currently viewed as a strategic asset because of global economic uncertainty. During 2009 central banks were net buyers of gold for the first time since 1997 (Censky, 2010). During the first half of 2010, total official central bank purchases of gold were 46 tonnes (Copeland, 2010). Central banks in Russia, Kazakhstan, Philippines and China were all gold buyers during 2010 (Censky, 2010). It is estimated that during the June quarter 2010, more than 270 tonnes of gold were purchased in exchange traded funds, reflecting strong investment demand for gold. Exchanged trade funds are investment vehicles, which aim to track the gold price, but do not necessarily hold physical gold (Copeland, 2010).

A number of new mines were being developed or came on stream during 2010. Gold Fields announced the commissioning of a new secondary crushing plant at its Damang gold mine in Ghana, which will help increase gold output by 20 per cent (Mineweb, 2010b). Goldfields has announced plans to open a new gold mine in Mali. The Komana project, which is likely to be developed during the next three years could increase the company's west African output to one million troy ounces (Mineweb, 2010c). Iamgold Corp has opened its Essakane mine in Burkino Faso. The operation is expected to produce more than 500 000 troy ounces of gold from start-up until the end of 2011 (Mineweb, 2010d). African Barrick Gold indicated that it is going to develop an underground mine beneath the existing open pits at

its North Mara Mine in Tanzania, following the discovery of an additional 370 000 troy ounces of gold (Mineweb, 2010e).

Coeur d'Alene has commenced production at the Kensington Gold Mine in Alaska. The operation's average production will be approximately 125 000 troy ounces of gold annually over the mine's initial 12.5 year life (Coeur, 2010). Integra Mining has produced its first gold at its Randalls gold project near Kalgoorlie in Western Australia (Mineweb, 2010f). Newcrest Mining has announced approval for the development of its Cadia East gold and copper project in central west New South Wales. The Cadia East deposit, one of the world's largest gold deposits, will be Australia's largest underground mine and will enable production from the Cadia Valley operations to increase to between 700 000 and 800 000 troy ounces of gold per annum over the first 10 years of operation (Mineweb, 2010g). Angel Mining announced that it had started production at is Nalunaq gold mine in Greenland. Once the operation reaches target production it will produce around 25 000 troy ounces of gold annually (Mineweb, 2010h).

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Mine production of gold

kilograms

Country	2005	2006	2007	2008	2009
Armenia	1 373	867	565	* 565	682
Azerbaijan	—	—	—	—	333
Bulgaria	3 868	3 818	3 964	4 160	4 482
Finland	3 747	5 292	4 621	4 148	* 1 785
Georgia	1 620	2 400	3 100	* 3 100	* 3 100
Greenland	1 828	2 324	1 835	1 648	—
Poland (a)	713	1 700	883	902	823
Romania	* 500	* 500	* 500	* 500	* 500
Russia	163 186	159 340	156 912	184 488	205 236
Serbia (a)	—	* 330	* 330	* 330	* 330
Serbia and Montenegro (a)	* 330	—	—	—	—
Slovakia	109	84	92	198	346
Spain	2 145	1 565	—	—	—
Sweden	6 564	6 848	5 159	4 953	5 542
Turkey	4 170	8 040	9 920	11 120	* 15 000
United Kingdom	—	—	88	163	188
Algeria	641	377	236	647	998
Botswana	2 709	3 020	2 722	3 176	1 626
Burkina Faso	1 397	1 571	2 250	7 633	13 181
Burundi	3 905	4 313	2 423	2 170	972
Cameroon	600	* 600	* 600	* 600	* 600
Congo, Democratic Republic	7 200	10 300	5 100	3 300	2 000
Equatorial Guinea	* 200	* 200	* 200	* 200	* 200
Ethiopia (b)	3 726	3 828	* 3 300	3 631	4 005
Gabon	* 300	* 300	* 300	* 300	* 300
Ghana	66 852	72 323	83 558	80 503	97 197
Guinea	25 097	14 914	13 948	16 389	21 402
Ivory Coast	1 638	1 323	1 243	4 205	6 947
Kenya (c)	616	432	3 023	340	1 055
Liberia	25	9	284	569	478
Mali	49 230	58 382	52 753	41 160	42 364
Mauritania	—	322	2 332	5 528	6 773
Morocco (a)	1 800	1 300	771	587	440
Mozambique	63	85	97	298	511
Namibia	2 649	2 790	2 496	2 126	2 022
Niger	4 962	2 615	3 427	2 314	2 067
Nigeria	* 40	40	180	2 890	1 350
Senegal	* 600	* 600	* 600	* 600	5 655
Sierra Leone	48	65	193	174	143
South Africa	294 803	272 128	252 345	212 744	197 628
Sudan	4 739	3 246	2 701	2 251	1 922
Tanzania	47 270	39 750	40 193	36 434	39 112
Togo	6 179	7 184	10 159	11 835	12 955
Uganda (c)	1 500	2 192	2 543	2 055	931
Zambia (d)	443	964	1 269	1 693	2 833
Zimbabwe	14 024	11 354	7 018	3 579	4 966
Canada	120 541	104 448	102 377	96 501	97 367
Costa Rica	540	1 850	1 221	* 154	* 205
Dominican Republic	—	—	—	44	375
Guatemala	741	5 036	7 100	7 448	8 484
Honduras	4 439	4 055	3 012	1 846	2 127
Mexico	26 782	35 899	39 355	50 365	51 393
Nicaragua	3 674	3 395	3 330	2 960	2 590
USA	255 757	251 853	238 136	233 327	223 323
Argentina	27 904	44 131	42 021	42 046	46 588
Bolivia	8 871	9 628	8 818	8 431	7 217
Brazil	38 293	40 075	49 600	54 000	57 000
Chile	40 447	42 100	41 528	39 162	40 834
Colombia	35 783	15 683	15 483	34 321	47 838
Ecuador	5 228	5 338	3 186	3 240	* 3 240
French Guiana	2 576	3 083	2 844	1 941	1 250
Guyana	5 668	6 405	7 412	8 131	9 326
Peru	207 822	202 822	170 128	179 870	182 390
Suriname	10 619	10 426	8 585	10 290	12 800

Mine production of gold

kilograms

Country	2005	2006	2007	2008	2009
Uruguay	2 930	* 2 800	3 172	2 429	2 010
Venezuela	10 480	11 600	10 092	10 100	10 500
Burma (a)	* 100	* 100	* 100	* 100	* 100
China (a)	255 000	247 500	275 000	285 000	320 000
India (e)	3 047	2 488	2 969	2 464	2 108
Indonesia	143 205	85 411	117 854	64 390	127 716
Iran (a)	275	850	850	* 850	* 850
Japan	8 319	8 904	8 869	6 868	7 708
Kazakhstan (a)	18 062	22 564	21 824	20 825	22 525
Korea (Rep. of)	260	277	162	175	274
Kyrgyzstan	16 751	10 301	10 559	18 132	* 17 200
Laos	6 338	6 068	4 161	4 333	5 021
Malaysia	4 250	3 496	2 913	2 489	2 794
Mongolia	24 122	21 267	17 473	15 184	9 803
Oman	350	358	248	118	93
Philippines	37 490	36 141	38 792	35 568	37 047
Saudi Arabia	7 457	5 182	4 438	4 527	4 427
Tajikistan	1 927	1 920	2 000	1 672	1 361
Thailand	4 393	3 470	3 401	2 721	5 400
Uzbekistan	84 210	76 620	72 850	* 73 000	* 73 000
Vietnam	* 3 000	* 3 000	* 3 000	* 3 000	* 3 000
Australia	263 000	247 000	247 000	215 000	222 000
Fiji	2 793	1 403	29	700	1 091
New Zealand	10 583	10 618	8 833	13 403	13 442
Papua New Guinea	68 200	58 349	57 549	67 466	67 800
Solomon Islands	20	20	93	141	130
World Total	2 510 000	2 360 000	2 340 000	2 290 000	2 460 000

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, Madagascar, Rwanda, Taiwan and Ukraine produce less than 100 kg gold per year

(3) Greece and Norway are believed to produce gold

(a) Metal production

(b) Years ended 7 July of that stated

(c) Exports

(d) Contained in blister copper, refinery muds and electrolytic copper

(e) Years ended 31 March following that stated

Production of graphite

tonnes (metric)

Country	2005	2006	2007	2008	2009
Austria	—	—	—	(a) 250	(a) 750
Bosnia & Herzegovina	...	...	...	272 084	133 819
Czech Republic	3 000	5 000	3 000	3 000	—
Germany	2 638	—	—	—	—
Norway	9 000	9 000	3 000	4 100	4 562
Romania	486	—	—	—	—
Russia	* 14 000	* 14 000	* 14 000	* 14 000	* 14 000
Turkey	* 1 100	1 200	* 1 500	* 1 500	* 1 500
Ukraine	10 400	5 800	* 8 000	* 8 000	* 8 000
Madagascar	6 400	4 857	* 5 000	* 5 000	* 5 000
Zimbabwe	6 177	6 588	5 418	5 134	2 463
Canada	* 17 000	15 000	15 000	20 000	* 7 000
Mexico	12 357	11 773	9 900	7 229	5 105
Brazil (b)	75 515	76 194	77 163	80 500	75 000
China (c)	1 650 000	1 730 000	1 800 000	1 800 000	* 1 750 000
India (a)(d)	125 651	162 293	170 813	132 329	106 950
Korea (Rep. of)	39	68	52	73	48
Korea, Dem. P.R. of	* 30 000	* 30 000	* 30 000	* 30 000	* 30 000
Sri Lanka	4 370	5 756	9 593	6 615	3 171
World Total	2 000 000	2 100 000	2 200 000	2 400 000	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) Including flake graphite
(d) Years ended 31 March following that stated

Production of gypsum

tonnes (metric)

Country	2005	2006	2007	2008	2009
Austria					
Gypsum	911 162	936 072	1 006 416	1 022 983	(a) 910 945
Anhydrite	106 032	135 380	57 428	64 276	...
Azerbaijan	28 242	35 034	22 037	2 208	2 969
Bosnia & Herzegovina (a)	152 939	131 936	154 294	150 039	74 302
Bulgaria	187 700	215 800	234 300	21 200	127 600
Croatia	196 133	170 351	170 721	* 250 000	318 139
Cyprus	215 500	270 000	330 000	412 000	317 000
Czech Republic	25 000	16 000	66 000	35 000	13 000
France (a)	4 902 498	* 4 800 000	* 4 800 000	2 339 380	3 351 339
Georgia	238	123	...	—	...
Germany (a)	1 644 000	1 771 000	1 898 000	2 112 000	1 898 000
Greece	865 216	* 850 000	836 967	(a) 1 000 000	(a) 730 000
Hungary (a)	19 000	30 000	26 000	15 940	19 766
Ireland, Republic of	* 700 000	* 700 000	* 700 000	* 600 000	* 400 000
Italy	* 1 600 000	1 600 000	* 1 600 000	* 1 600 000	* 1 600 000
Latvia (a)	273 000	330 000	346 000	349 000	175 000
Macedonia	190 232	267 760	255 500	242 400	154 550
Moldova (b)	562 700	725 900	* 800 000	* 700 000	* 200 000
Poland					
Gypsum	1 048 000	1 172 000	1 298 000	1 283 000	(a) 1 326 928
Anhydrite	195 000	181 000	194 000	198 000	...

Production of gypsum

tonnes (metric)

Country	2005	2006	2007	2008	2009
Portugal	389 180	366 599	418 035	372 731	* 400 000
Romania	532 867	615 072	1 004 150	832 248	* 800 000
Russia	* 2 200 000	* 2 200 000	* 2 300 000	* 2 400 000	* 2 300 000
Serbia	—	* 42 000	* 42 000	* 42 000	* 42 000
Serbia and Montenegro	* 42 000	—	—	—	—
Slovakia (a)	107 500	126 200	151 000	152 000	131 000
Spain	14 453 053	14 596 559	14 535 422	11 955 753	* 9 000 000
Switzerland	* 300 000	* 300 000	* 300 000	* 300 000	* 300 000
Turkey	* 3 500 864	* 4 369 771	* 3 241 177	* 3 000 000	* 3 000 000
Ukraine	656 000	375 900	741 580	1 160 910	711 490
United Kingdom	* 1 700 000	* 1 700 000	* 1 700 000	* 1 700 000	* 1 700 000
Algeria	857 502	1 033 107	1 198 303	1 671 651	1 756 781
Egypt (a)	3 290 000	* 3 300 000	3 085 000	2 400 000	* 2 000 000
Eritrea	1 142	634	874	* 800	* 800
Ethiopia (c)	34 729	38 809	29 886	32 989	* 30 000
Kenya	* 9 100	* 9 100	* 9 600	* 9 600	* 9 600
Libya	* 175 000	* 200 000	* 240 000	* 240 000	* 240 000
Madagascar	500	500	500	* 500	* 500
Mauritania	43 266	45 222	49 229	44 428	36 928
Morocco	* 600 000	* 600 000	* 600 000	* 600 000	* 600 000
Niger	17 417	13 043	4 615	8 661	* 9 000
Nigeria	150 000	169 370	579 000	* 380 000	* 160 000
Somalia	* 1 500	* 1 500	* 1 500	* 1 500	* 1 500
South Africa	547 581	554 020	643 630	571 343	597 571
Sudan	* 5 000	7 000	7 974	12 705	30 000
Tanzania	63 377	32 798	2 730	55 730	8 105
Tunisia	113 000	151 000	157 000	* 160 000	* 160 000
Uganda	285	121	168	84	* 100
Canada (a)	8 272 000	9 072 000	7 638 000	5 797 000	3 540 000
Cuba	73 100	72 500	80 200	110 000	78 000
Dominican Republic	352 242	354 241	320 683	369 592	77 201
El Salvador	* 6 000	* 6 000	* 6 000	* 6 000	* 6 000
Guatemala	349 589	226 800	495 335	127 387	18 733
Honduras	* 5 700	* 5 500	* 5 500	* 5 500	* 5 500
Jamaica	302 066	364 432	227 697	238 274	156 877
Mexico	6 251 969	6 075 893	6 918 973	6 933 279	7 542 721
Nicaragua	36 456	42 191	43 300	49 900	37 400
USA	21 100 000	21 100 000	17 900 000	14 400 000	* 9 400 000
Argentina	1 073 286	1 202 812	1 226 530	1 257 310	1 356 025
Brazil	1 582 248	1 711 671	1 923 119	3 100 000	3 000 000
Chile	660 753	845 331	773 119	773 749	723 928
Colombia	* 700 000	* 700 000	* 700 000	* 700 000	* 700 000
Ecuador	1 310	1 478	* —	* —	* —
Paraguay	* 4 500	* 4 500	* 4 500	* 4 500	* 4 500
Peru	334 595	394 289	329 687	495 212	320 887
Venezuela	6 000	* 7 000	* 7 000	* 7 000	* 7 000
Afghanistan	...	...	...	44 180	42 120
Bhutan	150 585	204 198	189 198	248 445	299 735
Burma (d)	69 735	72 654	76 401	92 474	85 872
China	32 000 000	35 000 000	* 48 000 000	* 35 000 000	* 33 000 000
India (d)(e)	3 291 478	3 005 572	3 400 050	3 715 978	3 516 000
Indonesia	* 6 000	* 6 000	* 6 000	* 6 000	* 6 000
Iran (f)	11 195 745	10 761 107	11 930 563	11 251 070	* 11 250 000
Iraq	...	...	1 285 000	1 279 000	5 026 495
Israel	106 798	110 754	82 974	9 975	9 152
Jordan	344 911	333 710	287 789	231 771	304 356
Kazakhstan	516 600	649 400	653 600	696 900	* 700 000
Laos	239 000	206 100	232 300	337 300	761 300
Mongolia	81 223	60 400	* 60 000	* 60 000	* 60 000
Oman	133 100	254 000	183 200	179 800	* 180 000
Pakistan (g)	552 496	601 027	624 120	660 000	* 660 000
Saudi Arabia	713 000	* 750 000	* 750 000	* 750 000	* 750 000
Sri Lanka	272	548	—	617	—
Syria	467 000	443 800	447 900	572 886	403 137

Production of gypsum

tonnes (metric)

Country	2005	2006	2007	2008	2009
Tajikistan	8 500	...	51 000	45 000	20 800
Thailand					
Gypsum	7 113 073	8 354 901	8 643 391	8 500 401	8 678 597
Anhydrite	537 781	560 339	692 877	488 681	* 490 000
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	72 000	81 000	92 000	104 000	* 110 000
Australia (g)	3 881 600	4 264 900	3 896 100	3 604 153	3 428 199
World Total	146 300 000	153 200 000	166 100 000	142 800 000	132 700 000

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

(a) Including anhydrite
(b) Excluding output from the region east of the River Nistru and the Municipality of Bender
(c) Years ended 7 July of that stated
(d) Years ended 31 March following that stated
(e) Including selenite
(f) Years ended 20 March following that stated
(g) Years ended 30 June of that stated

Production of iodine

kilograms

Country	2005	2006	2007	2008	2009
Azerbaijan	—	—	21 500	116 400	148 700
Russia	* 105 000	* 105 000	* 105 000	* 105 000	* 105 000
USA	1 570 000	* 1 220 000	* 1 200 000	* 1 200 000	* 1 250 000
Chile	15 346 000	16 494 000	15 473 000	15 503 000	17 399 000
China	* 550 000	* 560 000	* 570 000	* 570 000	* 580 000
Indonesia	* 75 000	* 75 000	* 75 000	* 75 000	* 75 000
Japan	8 095 000	8 724 000	9 282 000	9 500 000	* 9 300 000
Turkmenistan	* 270 000	* 270 000	* 270 000	* 500 000	* 300 000
Uzbekistan	* 2 000	* 2 000	* 2 000	* 2 000	* 2 000
World Total	26 000 000	27 500 000	27 000 000	27 600 000	29 200 000

Production of iron ore

tonnes (metric)

Country	2005	2006	2007	2008	2009
Austria (a)	2 047 950	2 092 996	2 152 825	2 032 671	2 002 131
Azerbaijan	7 300	11 300	17 600	28 100	...
Bosnia & Herzegovina	3 045 654	3 439 587	2 943 963	2 667 359	2 727 452
Germany (b)(c)	362 106	416 000	421 711	455 100	363 699
Norway	713 000	620 000	630 000	746 000	896 000
Romania	220 788	122 684	8 157	—	—
Russia	95 100 000	102 000 000	105 000 000	99 900 000	92 000 000
Slovakia	534 000	583 000	570 000	392 000	...
Spain	—	—	—	—	—
Sweden	23 255 000	23 302 000	24 714 000	23 888 000	17 677 000
Turkey	3 889 934	3 251 969	4 549 556	3 990 110	4 169 972
Ukraine	69 456 000	74 000 000	77 930 000	72 688 000	66 452 000
United Kingdom	354	341	* 300	145	—
Algeria	1 878 800	2 339 637	1 982 101	2 077 000	1 307 000
Egypt	1 599 000	* 2 200 000	2 184 729	1 810 606	2 000 000
Mauritania	10 752 000	11 155 000	11 815 000	10 968 000	10 275 000
Morocco	16 300	35 500	47 958	22 878	29 600
Nigeria	84 790	88 180	57 900	62 000	99 424
South Africa (d)	39 542 072	41 326 036	42 100 887	48 982 537	55 313 053
Tunisia	206 400	217 300	180 600	108 300	151 200
Uganda	209	—	366	1 740	* 1 700
Zimbabwe	363 048	104 459	79 109	2 919	—
Canada (e)	28 343 000	34 094 000	33 158 000	32 102 000	31 699 000
Cuba	18 900	7 800	3 300	—	—
Guatemala	11 268	7 341	31 006	452	5 463
Mexico	14 468 000	14 568 000	16 540 000	17 709 000	17 693 000
USA	54 300 000	52 700 000	52 500 000	53 600 000	* 26 000 000
Brazil	281 462 088	317 800 229	354 674 378	351 200 000	327 000 000
Chile	7 862 000	8 629 000	8 817 700	9 315 580	8 242 300
Colombia	607 559	644 015	623 930	473 273	280 773
Peru	5 614 900	5 885 000	6 277 000	6 348 000	4 069 000
Venezuela	21 179 000	22 100 000	20 650 000	21 500 000	* 21 000 000
Bhutan	5 679	* 5 300	—	—	—
China	420 492 700	588 171 400	707 073 000	824 011 100	880 171 400
India (f)	165 230 000	187 696 000	213 246 000	215 437 000	213 370 900
Indonesia	32 203	5 489	—	—	—
Iran (g)	26 243 837	31 537 545	35 195 000	* 38 200 000	* 38 200 000
Iraq	...	...	40 000	3 000	—
Kazakhstan	19 471 100	18 254 900	19 582 200	21 486 300	22 281 300
Korea (Rep. of)	212 971	227 437	290 802	365 883	455 405
Korea, Dem. P.R. of	* 1 200 000	* 1 200 000	* 1 200 000	1 488 000	* 1 500 000
Malaysia (e)	949 605	667 082	802 030	981 932	1 470 186
Mongolia	167 700	180 000	265 100	1 387 400	1 379 000
Pakistan (h)	104 278	131 259	125 879	* 130 000	* 130 000
Thailand	230 946	264 289	1 554 860	1 709 750	528 899
Vietnam	1 435 000	* 1 600 000	* 1 200 000	* 1 200 000	* 1 800 000
Australia	261 796 000	275 042 000	299 038 000	342 435 000	394 069 000
New Zealand	2 207 244	2 146 496	1 723 726	2 020 227	585 978
World Total	1 567 000 000	1 831 000 000	2 052 000 000	2 214 000 000	2 248 000 000

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

Production of pig iron

tonnes (metric)

Country	2005	2006	2007	2008	2009
Austria	5 444 000	5 547 000	5 908 000	5 795 000	4 353 000
Azerbaijan	...	...	...	1 717	1 555
Belgium	7 254 000	7 516 000	6 577 000	6 977 000	7 407 000
Bosnia & Herzegovina	—	—	—	243 000	482 469
Bulgaria	1 115 000	1 147 000	1 069 000	441 000	...
Czech Republic	4 627 000	5 192 000	5 287 000	4 737 000	3 483 000
Finland	3 056 165	3 157 894	2 915 130	2 942 946	2 042 000
France	12 595 584	12 873 900	12 425 703	11 371 879	8 104 318
Germany	29 294 000	30 940 000	31 700 000	29 105 000	20 104 000
Hungary	1 329 000	1 340 000	1 393 655	1 288 758	1 050 000
Italy	11 392 000	11 500 000	11 100 000	10 400 000	5 670 000
Netherlands	6 031 000	5 417 000	6 412 000	6 130 000	4 655 000
Norway	* 100 000	* 100 000	* 100 000	* 100 000	* 100 000
Poland	4 476 831	5 332 632	5 804 418	4 933 781	3 095 053
Romania	4 097 998	3 945 975	3 923 244	2 957 715	1 575 000
Russia	51 750 000	55 022 000	51 500 000	48 300 000	43 900 000
Serbia	—	1 529 177	1 485 000	1 582 000	1 008 000
Serbia and Montenegro	1 115 195	—	—	—	—
Slovakia	3 681 000	4 145 000	4 012 000	3 529 000	3 019 000
Spain	4 160 000	3 432 000	3 976 000	3 995 000	2 920 000
Sweden	3 844 000	3 701 000	3 947 000	3 708 000	1 966 000
Turkey	5 398 500	5 952 000	6 235 537	6 697 372	6 913 325
Ukraine	31 700 000	32 900 000	35 650 000	30 991 000	25 683 000
United Kingdom	10 188 800	10 695 700	10 959 800	10 136 800	7 674 000
Algeria	791 400	1 093 000	1 193 000	690 000	493 000
Egypt	4 000 000	4 200 000	3 786 000	4 443 000	* 450 000
Libya	1 700 000	1 633 000	1 660 000	1 569 000	1 097 000
South Africa	7 900 000	7 913 000	7 094 000	6 540 000	5 762 000
Zimbabwe	* 129 000	38 000	38 000	1 000	—
Canada	8 865 000	8 751 000	9 490 000	9 744 000	5 559 000
Mexico	10 020 339	9 956 777	10 343 007	10 461 858	8 071 438
Trinidad & Tobago	2 055 300	2 071 500	2 062 800	1 601 000	1 181 700
USA	37 222 000	37 903 000	36 300 000	33 700 000	18 000 000
Argentina	4 466 500	4 437 400	4 389 100	4 428 000	2 849 000
Brazil	33 884 000	32 452 000	35 571 000	34 871 000	25 135 000
Chile	1 074 000	1 115 000	1 147 000	1 150 000	920 000
Colombia	325 200	352 600	340 900	308 100	634 000
Paraguay	123 000	128 000	110 000	95 000	71 000
Peru	385 700	427 100	495 500	466 000	100 000
Venezuela	8 986 800	8 571 500	7 435 300	6 827 200	5 508 000
Burma	* 40 000	* 40 000	* 40 000	* 40 000	* 40 000
China	343 751 900	412 451 900	469 446 300	470 674 100	543 748 200
India	39 177 000	43 288 000	46 884 000	49 050 000	50 681 000
Indonesia	1 268 000	1 200 000	1 321 000	—	—
Iran	9 178 000	8 970 000	9 609 000	9 600 000	10 760 000
Japan	83 058 130	84 270 419	86 770 755	86 171 136	66 942 610
Kazakhstan	3 582 198	3 369 395	3 795 352	3 105 548	2 409 000
Korea (Rep. of)	27 309 000	27 559 407	29 436 783	31 042 782	27 474 604
Korea, Dem. P.R. of	* 250 000	* 250 000	* 250 000	* 250 000	* 250 000
Malaysia	1 350 000	1 277 000	1 872 000	—	—
Pakistan	* 1 000 000	* 850 000	* 900 000	* 900 000	* 750 000
Qatar	815 382	876 885	1 296 000	1 637 778	2 096 282
Saudi Arabia	3 626 000	3 581 000	4 101 000	4 500 000	4 623 000
Taiwan	9 447 000	10 407 000	10 518 000	9 823 000	7 939 000
Vietnam	202 000	211 000	170 000	255 000	275 000
Australia	6 212 000	6 433 000	6 351 000	6 057 000	4 370 000
New Zealand	652 000	664 000	679 000	622 000	608 000
World Total	855 500 000	938 100 000	1 007 300 000	987 000 000	954 000 000

Note(s)

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

Production of crude steel

tonnes (metric)

Country	2005	2006	2007	2008	2009
Albania	179 524	205 534	263 271	300 000	250 000
Austria	7 031 000	7 129 000	7 577 000	7 593 000	5 662 000
Azerbaijan	286 100	335 300	273 393	74 801	78 874
Belarus	2 075 523	2 135 651	2 214 019	2 478 131	2 329 694
Belgium	10 422 000	11 631 000	10 692 000	10 673 000	5 635 000
Bosnia & Herzegovina	289 000	469 122	513 867	587 878	495 150
Bulgaria	1 969 000	2 102 000	1 909 000	1 330 000	726 000
Croatia	73 640	80 516	76 252	121 759	51 583
Czech Republic	6 189 000	6 862 000	7 059 000	6 387 000	4 594 000
Finland	4 738 446	5 053 714	4 430 726	4 416 792	3 078 000
France	19 480 777	19 852 125	19 249 862	17 879 161	12 840 108
Germany	44 524 000	47 223 000	48 550 000	45 832 000	32 670 000
Greece	2 266 000	2 416 000	2 554 000	2 477 000	2 000 000
Hungary	2 004 250	2 084 000	2 227 000	2 097 000	1 401 000
Italy	29 349 000	31 624 000	31 506 000	30 589 000	19 847 000
Latvia	550 000	* 690 000	* 696 000	* 635 000	* 692 000
Luxembourg	2 194 000	2 802 000	2 858 000	2 582 000	2 141 000
Macedonia	321 170	326 484	370 317	344 866	299 332
Moldova (a)	1 016 000	784 000	965 000	885 000	380 000
Montenegro	—	193 165	173 849	201 623	* 130 000
Netherlands	6 919 000	6 372 000	7 368 000	6 853 000	5 193 000
Norway	705 000	684 000	708 000	560 000	591 000
Poland	8 335 898	9 991 638	10 630 716	9 727 325	7 239 339
Portugal	1 338 000	1 338 000	1 847 000	1 630 000	1 587 000
Romania	6 280 000	6 266 036	6 269 486	5 035 164	2 761 000
Russia	66 300 000	70 800 000	72 400 000	68 700 000	59 200 000
Serbia	—	1 630 000	1 478 000	1 662 000	1 061 000
Serbia and Montenegro	1 292 000	—	—	—	—
Slovakia	4 485 000	5 093 000	5 082 000	4 489 000	3 747 000
Slovenia	583 000	628 000	638 000	642 000	428 000
Spain	17 825 000	18 391 000	18 998 000	18 640 000	14 357 000
Sweden	5 725 600	5 466 100	5 672 900	5 197 600	2 803 700
Switzerland	1 158 000	1 252 000	1 264 000	1 312 000	934 000
Turkey	20 961 240	23 307 523	25 760 889	26 809 050	25 303 741
Ukraine	38 641 000	40 892 000	43 646 655	38 136 117	30 301 844
United Kingdom	13 238 900	13 904 600	14 392 300	13 520 500	10 080 000
Algeria	1 007 000	1 158 000	1 278 000	646 000	458 000
Egypt	5 603 000	6 045 000	6 224 000	6 198 000	5 508 000
Libya	1 255 000	1 151 000	1 250 000	1 137 000	914 000
Morocco	205 000	314 000	512 000	478 000	479 000
Nigeria	* 100 000	* 100 000	* 100 000	* 100 000	* 100 000
South Africa	9 494 000	9 721 000	9 098 000	8 550 000	7 484 000
Tunisia	65 700	67 700	60 900	82 000	155 000
Zimbabwe	107 000	24 000	23 000	—	—
Canada	15 327 000	15 493 000	15 572 000	14 845 000	8 968 000
Cuba	245 076	257 200	262 400	273 800	265 800
Dominican Republic	* 66 000	* 81 000	* 75 000	* 68 000	* 67 000
El Salvador	48 000	72 000	73 000	71 000	56 000
Guatemala	207 000	292 000	349 000	250 000	224 000
Mexico	16 282 299	16 446 939	17 572 676	17 209 020	13 957 391
Trinidad & Tobago	712 000	673 000	694 600	489 600	417 000
USA	94 897 000	98 557 000	98 102 000	91 350 000	58 142 000
Argentina	5 382 000	5 532 700	5 387 600	5 541 400	4 013 000
Brazil	31 610 000	30 901 000	33 782 000	33 716 000	26 506 000
Chile	1 541 000	1 607 000	1 678 000	1 549 000	1 308 000
Colombia	1 007 000	1 211 000	1 245 000	1 053 000	1 052 000
Ecuador	82 500	86 400	87 100	129 100	259 000
Paraguay	100 600	103 400	109 100	82 800	64 000
Peru	789 500	900 700	857 000	1 001 900	718 000
Uruguay	64 000	56 700	71 100	85 700	56 000
Venezuela	4 907 400	4 692 800	5 005 300	4 224 500	3 808 000

Production of crude steel

tonnes (metric)

Country	2005	2006	2007	2008	2009
Burma	* 25 000	* 25 000	* 25 000	* 25 000	* 25 000
China	353 239 800	419 148 500	489 660 000	500 488 000	568 033 000
India	45 780 000	49 450 000	53 468 000	57 791 000	62 838 000
Indonesia	3 675 442	3 759 000	4 160 000	3 915 000	3 501 000
Iran	9 404 000	9 789 000	10 051 000	9 964 000	10 873 000
Israel	* 300 000	* 300 000	* 300 000	* 300 000	* 300 000
Japan	112 471 374	116 226 201	120 202 937	118 739 328	87 534 137
Jordan	150 000	150 000	150 000	150 000	150 000
Kazakhstan	4 476 642	4 244 521	4 784 105	4 243 582	4 146 000
Korea (Rep. of)	47 820 037	48 455 454	51 517 309	53 322 000	48 572 000
Korea, Dem. P.R. of	* 300 000	* 300 000	* 300 000	* 300 000	* 250 000
Kuwait	* 450 000	* 500 000	* 500 000	* 500 000	* 500 000
Malaysia	5 296 000	5 834 000	6 895 000	6 423 000	4 004 000
Mongolia	35 000	35 000	35 000	35 000	35 000
Pakistan	825 000	1 040 000	1 090 000	1 000 000	* 800 000
Philippines	470 000	558 000	718 000	711 000	824 000
Qatar	1 057 000	1 039 220	1 174 917	1 434 652	1 448 000
Saudi Arabia	4 186 000	3 974 000	4 644 000	4 667 000	4 690 000
Singapore	572 000	607 000	640 000	764 000	664 000
Syria	* 70 000	* 70 000	* 70 000	* 70 000	* 70 000
Taiwan	18 563 247	20 093 857	20 898 385	19 882 000	15 873 000
Thailand	5 161 000	4 914 000	5 565 000	5 211 000	3 646 000
United Arab Emirates	* 90 000	* 90 000	* 90 000	* 90 000	* 90 000
Uzbekistan	595 000	730 000	649 000	682 000	718 000
Vietnam	890 000	1 869 000	2 024 000	2 250 000	2 700 000
Australia	7 789 000	7 937 000	8 047 000	7 625 000	5 249 000
New Zealand	889 000	810 000	845 000	799 000	765 000
World Total	1 144 000 000	1 248 000 000	1 348 000 000	1 331 000 000	1 224 000 000

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

(a) Production from the region east of the River Nistru

Production of ferro-alloys

tonnes (metric)

Country	2005	2006	2007	2008	2009
Albania					
Ferro-chrome	35 780	13 230	920	8 392	5 288
Armenia					
Ferro-molybdenum	* 5 000	* 4 900	5 977	5 323	* 5 300
Austria					
Ferro-molybdenum	5 000	5 000	5 000	4 500	4 000
Ferro-nickel	2 500	2 500	3 000	2 000	2 500
Ferro-vanadium	6 250	6 250	6 500	6 300	6 200
Bulgaria					
Ferro-silicon	* 10 000	* 10 000	* 10 000	* 10 000	* 10 000
Czech Republic					
Ferro-vanadium	* 2 600	* 2 800	* 1 700	* 2 800	* 1 900
Finland					
Ferro-chrome	234 881	243 350	241 760	233 550	123 310
France					
Ferro-manganese & spiegeleisen	109 111	139 533	98 066	* 100 000	* 100 000
Ferro-silico-manganese	52 300	63 300	* 65 000	* 55 000	* 55 000
Ferro-silicon	* 67 000	* 67 000	* 71 000	* 22 000	* 20 000
Silicon metal	* 100 000	* 100 000	* 120 000	* 100 000	* 100 000
Georgia					
Ferro-manganese	13 945	5 130	* 5 000	* 5 000	* 5 000
Ferro-silico-manganese	109 414	116 945	107 986	123 468	* 120 000
Germany					
Ferro-chrome	22 672	26 710	22 030	26 960	13 667
Other ferro-alloys	* 25 400	* 24 100	* 5 000	* 5 000	* 5 000
Silicon metal	29 349	29 865	29 379	29 092	27 620
Greece					
Ferro-nickel	* 96 000	* 89 000	93 300	83 200	41 300
Iceland					
Ferro-silicon	114 844	113 798	114 886	107 882	135 834
Italy					
Ferro-manganese	32 000	* 30 000	* 30 000	* 30 000	* 20 000
Ferro-silico-manganese	99 000	96 600	87 000	87 000	56 000
Macedonia					
Ferro-nickel	8 141	10 942	15 321	15 026	12 000
Ferro-silicon	71 249	59 023	78 892	97 605	7 657
Norway					
Ferro-manganese	* 130 000	* 130 000	* 130 000	* 130 000	* 130 000
Ferro-silico-manganese	288 137	325 708	293 699	273 485	* 250 000
Ferro-silicon	329 316	123 819	170 024	185 344	233 974
Other ferro-alloys	* 60 000	* 60 000	* 62 000	* 60 000	* 60 000
Silicon metal	178 572	* 150 000	* 140 000	* 155 000	* 150 000
Poland					
Ferro-manganese	7 782	4 089	2 093	8 475	1 736
Ferro-silico-manganese	10 242	3 310	15 590	25 061	72
Ferro-silicon	65 118	13 034	58 538	56 031	9 685
Other ferro-alloys	3 663	4 488	6 255	2 948	4 190
Romania					
Ferro-chrome	—	—	—	6 179	...
Ferro-manganese	18 625	3 777	—	—	—
Ferro-silico-manganese	100 957	66 476	26 868	9 979	...
Russia					
Spiegeleisen	* 7 000	* 7 000	* 7 000	* 7 000	* 7 000
Pig iron & spiegeleisen	6 700	7 500	7 136	7 000	7 000
Ferro-chrome	511 600	500 837	564 474	475 686	235 600
Ferro-silico-chrome	74 150	92 404	97 915	72 050	8 285
Ferro-manganese	* 110 000	* 130 000	* 120 000	* 110 000	* 110 000
Ferro-silico-manganese	* 48 000	* 40 000	* 40 000	* 40 000	* 40 000
Ferro-nickel	22 050	* 29 085	* 26 031	* 39 503	* 40 000
Ferro-silicon	742 000	882 300	896 100	* 850 000	* 850 000
Other ferro-alloys	* 35 000	* 33 000	* 34 000	* 34 000	* 34 000
Silicon metal	* 75 000	* 58 000	* 54 500	* 54 000	* 54 000
Slovakia					
Ferro-chrome	867	19	—	—	—
Ferro-silico-manganese	47 843	59 128	71 587	59 940	...
Ferro-silicon	16 512	16 155	8 583	10 844	...
Other ferro-alloys	48 161	65 498	74 065	61 194	...

Production of ferro-alloys

tonnes (metric)

Country	2005	2006	2007	2008	2009
Slovenia					
Ferro-silicon	15 529	12 550	* 6 000	* —	* —
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	127 500	136 400	124 400	118 700	* 50 000
Ferro-silicon	9 800	4 600	4 300	—	—
Turkey					
Ferro-chrome	26 043	67 975	69 730	75 840	41 028
Ferro-silico-chrome	6 695	7 310	6 624	6 094	2 903
Ukraine					
Pig iron & spiegeleisen	35 000	35 000	35 000	35 000	35 000
Spiegeleisen	* 5 000	* 5 000	—	—	—
Ferro-manganese	359 000	373 000	368 321	361 501	135 339
Ferro-silico-manganese	1 045 900	1 168 000	1 281 073	958 667	771 950
Ferro-nickel	* 80 000	* 90 000	95 619	97 848	76 487
Ferro-silicon	227 500	169 000	218 485	201 706	193 034
Other ferro-alloys	87 985	133 402	53 174	43 127	23 882
Egypt					
Ferro-silicon (a)	55 000	50 000	48 464	59 192	78 355
Other ferro-alloys (a)	* 30 000	* 30 000	* 30 000	* 30 000	* 30 000
Gambia					
Pig iron & spiegeleisen	—	410	355	—	—
Mozambique					
Pig iron & spiegeleisen	...	...	26 347	29 000	29 000
South Africa					
Pig iron & spiegeleisen	314 000	414 400	388 800	404 000	392 000
Ferro-chrome	2 811 836	2 893 400	3 551 983	3 268 659	2 341 754
Ferro-manganese	570 574	* 600 000	* 672 000	* 498 000	* 257 000
Ferro-silico-manganese	275 324	* 350 000	* 355 000	* 263 000	* 136 000
Ferro-silicon	127 000	* 140 000	* 140 000	* 137 000	* 110 000
Ferro-vanadium	19 000	18 000	* 19 000	* 17 000	* 17 000
Silicon metal	53 500	* 50 000	* 50 108	* 49 146	* 39 000
Swaziland					
Ferro-vanadium	345	—	—	—	—
Zimbabwe					
Ferro-chrome	238 507	200 673	187 327	145 430	72 223
Ferro-silicon	4 882	1 024	3 097	1 612	603
Canada					
Ferro-niobium	* 4 800	* 6 400	* 6 500	* 6 700	* 6 600
Ferro-silicon	* 70 000	* 70 000	* 70 000	* 70 000	* 70 000
Silicon metal	* 30 000	* 30 000	* 30 000	* 30 000	* 50 000
Dominican Republic					
Ferro-nickel	73 962	76 659	75 069	47 408	—
Mexico					
Ferro-manganese	89 642	64 318	74 578	97 366	42 492
Ferro-silico-manganese	104 780	97 457	109 286	114 320	85 065
USA					
Pig iron & spiegeleisen	164 000	143 000	121 000	122 000	100 000
Ferro-silicon	209 000	253 000	271 000	287 000	245 000
Silicon metal	148 000	* 148 000	* 150 000	* 150 000	* 150 000

Production of ferro-alloys

tonnes (metric)

Country	2005	2006	2007	2008	2009
Brazil					
Pig iron & spiegeleisen	25 657	25 120	26 739	25 300	* 25 000
Ferro-chrome	185 533	158 585	177 656	209 273	108 893
Ferro-silico-chrome	16 683	8 221	12 943	13 674	1 750
Ferro-silico-magnesium	43 980	31 314	30 221	30 800	18 300
Ferro-manganese	257 083	61 434	135 757	149 900	44 600
Ferro-silico-manganese	341 565	198 753	225 373	238 000	109 500
Ferro-nickel	21 200	27 600	28 900	26 300	31 600
Ferro-niobium	58 616	60 826	71 676	81 600	48 900
Ferro-silicon	199 856	196 814	196 403	183 000	175 000
Other ferro-alloys	42 588	44 280	45 330	47 800	21 200
Silicon metal	229 294	226 380	225 120	219 600	154 000
Colombia					
Ferro-nickel	122 700	118 900	114 600	97 000	118 000
Venezuela					
Ferro-manganese	* 15 000	* 15 000	* 15 000	* 15 000	* 15 000
Ferro-silico-manganese	* 35 000	* 35 000	* 35 000	* 35 000	* 35 000
Ferro-nickel	56 300	57 000	* 57 000	* 57 000	* 57 000
Ferro-silicon	* 92 000	* 92 000	* 92 000	* 92 000	* 92 000
Bhutan					
Ferro-silicon	* 20 000	* 20 000	* 21 000	* 36 600	* 36 600
China					
Pig iron & spiegeleisen	120 000	135 000	140 000	140 000	140 000
Ferro-chrome	854 000	1 042 500	1 296 000	1 505 800	1 813 000
Ferro-silico-chrome	48 000	35 000	38 700	72 300	116 000
Other ferro-alloys	9 798 000	13 223 000	16 165 000	16 722 000	20 171 000
Silicon metal	* 650 000	* 730 000	* 820 000	* 820 000	* 540 000
India					
Pig iron & spiegeleisen	27 133	20 535	35 976	* 36 000	* 36 000
Ferro-aluminium (b)	7 214	9 947	9 377	8 170	7 017
Ferro-chrome (b)	662 297	801 368	948 601	817 239	892 100
Ferro-silico-magnesium (b)	11 171	11 387	13 525	13 400	17 132
Ferro-manganese (b)	273 057	296 726	391 210	384 577	389 465
Ferro-silico-manganese (b)	596 372	782 962	911 402	891 458	1 099 838
Ferro-molybdenum (b)	2 827	3 120	2 899	2 162	2 822
Ferro-silicon (b)	90 652	92 632	83 716	99 595	101 917
Ferro-titanium (b)	735	1 761	1 937	1 661	2 379
Ferro-vanadium (b)	877	1 139	1 585	1 501	1 389
Other ferro-alloys (b)	225	409	362	541	569
Indonesia					
Pig iron & spiegeleisen	2 600	65 000	111 000	65 000	63 000
Ferro-manganese	* 12 000	* 12 000	* 12 000	* 12 000	* 12 000
Ferro-silico-manganese	* 4 000	* 5 000	* 6 000	* 7 000	* 7 000
Ferro-nickel	20 036	14 774	18 532	17 566	12 550
Iran					
Ferro-chrome (c)	* 8 000	* 8 000	* 8 000	* 5 000	* 9 000
Ferro-silicon (c)	* 50 000	* 50 000	* 50 000	* 50 000	* 50 000
Japan					
Ferro-chrome	12 367	13 056	12 016	13 888	7 698
Ferro-manganese	448 616	406 162	420 151	431 181	361 375
Ferro-silico-manganese	94 725	59 424	52 901	58 884	49 205
Ferro-molybdenum	4 019	4 229	4 573	4 554	3 598
Ferro-nickel	391 074	335 884	351 503	301 361	284 884
Ferro-vanadium	2 360	2 042	3 205	3 477	2 560
Other ferro-alloys	10 057	13 123	13 982	14 478	12 957
Kazakhstan					
Ferro-chrome	1 156 167	1 190 673	1 307 536	1 220 315	977 235
Ferro-silico-chrome	97 870	117 607	145 685	133 828	51 576
Ferro-silico-manganese	170 001	218 323	188 445	179 939	181 776
Ferro-silicon	104 186	85 924	59 886	54 964	30 028
Other ferro-alloys	...	1 787	1 222	1 473	...
Korea (Rep. of)					
Ferro-manganese	124 000	169 202	209 321	251 125	...
Ferro-silico-manganese	74 000	94 119	105 607	76 184	...
Korea, Dem. P.R. of					
Ferro-alloys	* 10 000	* 10 000	* 10 000	* 10 000	* 10 000

Production of ferro-alloys

tonnes (metric)

Country	2005	2006	2007	2008	2009
Malaysia					
Pig iron & spiegeleisen	4 954	1 690	7 393	984	1 145
Sri Lanka					
Pig iron & spiegeleisen	23 587	8 321	381	1 447	10 267
Thailand					
Pig iron & spiegeleisen	—	—	1 023	—	—
Vietnam					
Pig iron & spiegeleisen	35 000	27 000	22 000	24 000	8 000
Australia					
Pig iron & spiegeleisen	426 000	491 000	600 000	528 000	474 000
Ferro-manganese (a)	166 513	114 715	133 816	128 000	* 130 000
Ferro-silico-manganese (a)	96 575	103 207	105 800	126 000	* 120 000
Silicon metal	* 30 000	* 30 000	* 30 000	* 30 000	* 30 000
New Caledonia					
Ferro-nickel	172 067	180 724	170 870	148 960	156 553

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

Production of kaolin

tonnes (metric)

Country	2005	2006	2007	2008	2009
Albania	310 000	579 200	1 097 000	759 170	884 940
Austria	16 410	17 431	16 929	16 460	18 148
Belgium	* 300 000	* 300 000	* 300 000	* 300 000	* 300 000
Bosnia & Herzegovina	14 500	69 643	188 033	259 325	148 384
Bulgaria	* 200 000	* 240 000	* 240 000	* 220 000	* 140 000
Czech Republic (a)	649 000	673 000	682 000	672 000	525 000
France	319 464	* 300 000	(b) 350 742	(b) 335 520	(b) 227 342
Germany (c)	3 767 662	3 815 173	3 842 514	3 622 159	4 513 753
Greece	49 912	* 40 000	30 000	4 360	—
Hungary	1 300	1 350	2 136	—	—
Italy	183 804	* 180 000	* 180 000	* 180 000	* 180 000
Poland (d)	159 207	148 579	153 670	165 615	136 561
Portugal	164 072	167 792	183 598	231 346	270 450
Romania	26 772	11 063	7 576	3 060	...
Russia	* 45 000	* 45 000	* 45 000	* 45 000	* 45 000
Serbia	—	214 735	97 432	398 917	163 616
Serbia and Montenegro	135 000	—	—	—	—
Slovakia	31 000	58 000	46 000	44 000	10 000
Spain (d)	463 398	476 327	489 428	355 739	337 900
Turkey	615 271	* 600 000	456 238	232 746	234 614
Ukraine (a)	216 600	251 000	244 000	240 000	* 100 000
United Kingdom	1 910 874	1 762 328	1 671 426	1 355 365	1 059 848
Algeria	34 386	32 523	106 567	50 788	87 766
Egypt	415 400	* 400 000	331 671	523 327	* 500 000
Eritrea	471	129	183	* 200	* 175
Ethiopia (e)	3 726	1 641	4 000	1 300	1 613
Kenya	780	810	910	940	* 1 000
Nigeria	60 000	96 590	* 100 000	* 100 000	* 100 000
South Africa	59 356	51 602	51 218	39 506	31 048
Sudan	...	11 641	27 846	87 151	66 379
Uganda	55	—	8 152	3 738	* 4 000

Production of kaolin

tonnes (metric)

Country	2005	2006	2007	2008	2009
Cuba	3 457	1 700	2 000	—	—
Guatemala	4 107	4 395	28 225	2 803	1 879
Mexico	877 147	961 800	970 598	690 366	406 421
USA (f)	7 800 000	7 470 000	7 110 000	* 6 280 000	* 5 200 000
Argentina	54 903	49 619	69 354	73 838	78 792
Brazil (a)	2 410 000	2 455 000	2 480 000	2 670 000	* 2 500 000
Chile	15 183	44 642	87 901	63 526	48 354
Ecuador	25 078	11 504	18 618	13 000	* 13 000
Paraguay	* 66 600	* 66 000	* 66 000	* 66 000	* 66 000
Peru	1 200	1 022	4 772	13 215	9 347
Venezuela	* 10 000	* 10 000	* 10 000	* 10 000	* 10 000
Bangladesh (g)	13 738	19 766	* 20 000	* 20 000	* 20 000
China	3 120 000	3 270 000	2 781 000	* 3 000 000	* 3 000 000
India (h)(i)	238 759	273 262	115 139	97 587	* 78 000
Indonesia	* 15 000	* 15 000	* 15 000	* 15 000	* 15 000
Iran (j)	531 109	803 270	947 884	1 274 092	* 1 274 000
Iraq	...	...	3 545	1 524	1 980
Japan	* 12 000	* 12 000	* 12 000	* 12 000	* 12 000
Jordan	168 264	112 787	100 584	181 018	148 940
Korea (Rep. of)	1 074 936	958 836	1 053 576	1 182 199	890 157
Malaysia	494 511	341 223	587 508	506 462	463 736
Pakistan (g)	37 732	53 051	30 979	32 000	* 32 000
Philippines	6 927	2 232	2 200	2 391	2 389
Saudi Arabia	1 489	3 957	4 415	5 560	...
Sri Lanka	9 914	10 914	11 178	10 039	9 538
Taiwan	9 423	4 107	5 060	33 745	18 413
Thailand (a)	156 853	157 900	159 186	162 215	* 160 000
Uzbekistan (h)	* 150 000	* 150 000	* 150 000	* 150 000	* 150 000
Vietnam	* 650 000	* 650 000	* 650 000	* 650 000	* 650 000
Australia (g)	231 611	182 304	213 605	181 655	109 400
New Zealand	15 750	14 864	14 130	12 761	9 016
World Total	28 400 000	28 700 000	28 700 000	27 700 000	21 000 000

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

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

Mine production of lead

tonnes (metal content)

Country	2005	2006	2007	2008	2009
Bosnia & Herzegovina	1 100	1 152	4 633	6 029	3 781
Bulgaria	24 354	19 571	17 768	14 577	12 981
Greece	2 900	11 400	13 400	14 000	10 000
Ireland, Republic of	72 200	61 800	56 800	50 200	49 500
Italy	* 6 000	* 6 000	* 3 000	* 3 000	* 3 000
Kosovo	—	—	—	(a) 6 076	(a) 4 574
Macedonia	—	11 531	36 039	49 877	46 788
Poland	78 980	77 450	61 330	67 070	54 900
Romania	11 610	6 269	784	—	—
Russia	36 400	34 000	48 000	60 000	78 000
Serbia	—	1 400	1 600	1 600	1 800
Serbia and Montenegro	1 300	—	—	—	—
Sweden	60 445	55 644	63 224	63 489	69 293
Turkey	11 341	14 000	14 000	21 000	15 000
United Kingdom	* 400	* 400	* 300	* 300	* 300
Morocco	46 000	41 300	41 976	33 477	33 799
Namibia	14 320	11 830	10 543	14 062	20 000
Nigeria	400	1 300	4 500	10 400	8 800
South Africa	42 159	48 273	41 857	46 440	49 149
Tunisia	8 407	—	—	—	—
Canada	79 254	83 096	75 135	99 810	68 761
Guatemala	23	28	363	—	—
Honduras	10 488	11 775	10 215	12 545	14 471
Mexico	134 388	135 025	137 133	141 173	143 838
USA	436 500	429 300	444 300	410 100	405 800
Argentina	10 683	12 064	17 045	20 788	24 753
Bolivia	11 231	11 955	22 798	81 602	84 538
Brazil	16 063	16 007	15 522	15 400	10 000
Chile	878	672	1 305	3 985	1 511
Peru	319 345	313 332	329 154	345 109	302 142
Burma	* 2 000	* 2 000	* 1 000	* 1 000	* 4 000
China	1 142 000	1 331 000	1 402 000	1 402 700	1 610 000
India (b)	59 731	67 363	77 641	82 842	84 025
Iran (c)	21 179	30 000	31 864	26 905	* 27 000
Japan	3 400	800	—	—	—
Kazakhstan	45 370	48 100	40 200	38 800	39 400
Korea (Rep. of)	50	17	12	225	1 032
Korea, Dem. P.R. of	* 20 000	* 25 000	* 35 000	* 33 000	* 28 000
Saudi Arabia	...	...	123	347	685
Thailand	...	...	...	* 5 000	* 3 000
Vietnam	* 6 900	* 9 500	* 4 400	* —	6 000
Australia	767 000	668 000	641 000	650 000	566 000
World Total	3 500 000	3 600 000	3 700 000	3 800 000	3 900 000

Note(s)
(a) Metal content of ore
(b) Years ended 31 March following that stated
(c) Years ended 20 March following that stated

Production of refined lead

tonnes (metric)

Country	2005	2006	2007	2008	2009
Austria	* 24 000	* 22 000	* 22 000	* 22 000	* 22 000
Belgium	103 000	101 000	117 000	104 000	109 000
Bulgaria	81 000	76 000	87 000	90 900	83 100
Czech Republic	26 000	26 000	26 000	26 000	26 000
Estonia	7 000	9 000	10 000	10 000	10 000
France	* 90 000	* 88 000	* 88 000	82 100	62 000
Germany	417 700	379 000	355 000	415 100	390 600
Greece	* —	* 6 000	* 11 000	* 11 000	* 11 000
Ireland, Republic of	22 500	21 700	22 500	20 000	19 000
Italy	211 000	190 500	211 800	199 900	149 000
Kosovo	—	—	—	—	4 250
Netherlands	* 17 000	* 16 000	* 16 000	* 16 000	* 17 000
Poland	81 000	82 200	104 200	108 300	100 400
Portugal	3 000	3 000	5 000	5 000	4 000
Romania	37 900	34 133	39 369	39 596	6 000
Russia	65 700	80 000	103 000	112 000	118 000
Slovenia	15 000	15 000	15 000	15 000	14 000
Spain	110 000	129 000	128 000	125 000	130 000
Sweden	72 760	70 239	69 730	56 812	51 574
Switzerland	9 600	* 9 000	* 9 000	* 8 000	800
Turkey	* 6 000	* 6 000	* 6 000	* 6 000	* 6 000
Ukraine	61 400	56 300	62 100	54 700	80 000
United Kingdom	304 350	318 703	263 391	283 000	301 865
Algeria	* 6 000	* 6 000	* 6 000	* 6 000	* 6 000
Kenya	* 1 000	* 1 000	* 1 000	* 1 000	* 1 000
Morocco	54 000	45 000	45 000	37 400	26 200
Nigeria	* 5 000	* 5 000	* 5 000	* 5 000	* 5 000
South Africa	65 300	67 000	59 000	62 000	58 000
Zambia	500	500	500	500	500
Canada	230 237	250 464	236 688	259 074	258 854
El Salvador	10 000	10 000	10 000	11 000	12 000
Mexico	213 700	232 300	198 293	206 364	200 410
USA (a)	1 293 000	1 297 000	1 303 000	1 280 500	1 214 100
Argentina	45 607	49 064	60 600	62 500	83 000
Brazil (b)	104 904	142 653	142 540	143 000	143 500
Colombia	* 10 000	* 10 000	* 10 000	* 10 000	* 10 000
Peru	122 079	120 311	116 774	114 259	26 082
Venezuela	* 35 000	* 36 000	* 36 000	* 37 000	* 36 000
Burma	500	500	200	200	200
China	2 391 400	2 714 900	2 788 300	3 206 400	3 707 900
India	59 000	114 000	132 000	165 000	197 000
Indonesia	18 000	18 000	18 000	18 000	18 000
Iran	71 000	74 000	78 000	75 000	76 000
Israel	28 000	25 000	25 000	27 000	26 000
Japan	274 600	280 000	276 300	279 500	247 700
Kazakhstan	135 400	115 974	117 641	105 766	87 800
Korea (Rep. of)	256 000	240 000	260 000	270 000	238 000
Korea, Dem. P.R. of	9 000	8 000	7 000	7 000	7 000
Malaysia	42 000	44 000	17 000	25 000	54 000
Pakistan	* 2 000	* 2 000	* 2 000	* 2 000	* 2 000
Philippines	* 30 000	* 30 000	* 34 000	* 34 000	* 32 000
Saudi Arabia	36 000	38 000	37 000	38 000	39 000
Taiwan	55 000	42 000	36 000	38 000	36 000
Thailand	61 100	61 160	73 159	73 303	55 504
United Arab Emirates	* 2 000	* 2 000	* 2 000	* 2 000	* 2 000

Production of refined lead

tonnes (metric)

Country	2005	2006	2007	2008	2009
Australia	267 000	241 000	239 000	260 000	234 000
New Zealand	* 9 000	* 11 000	* 11 000	* 11 000	* 11 000
World Total	7 700 000	8 100 000	8 200 000	8 700 000	8 900 000

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

Production of lithium minerals

tonnes (metric)

Country	2005	2006	2007	2008	2009
Portugal					
Lepidolite	26 185	28 497	34 755	34 888	38 500
Spain					
Lepidolite	6 751	8 339	10 326	9 342	* 7 000
Zimbabwe	37 499	—	—	—	—
Canada	* 22 500	* 22 500	* 23 000	* 22 000	* 22 000
USA (a)	* 1 500	* 1 500	* 1 500	* 1 500	* 1 500
Argentina (b)(c)	15 700	16 560	6 691	6 783	5 016
Brazil					
Spodumene	8 924	8 585	7 991	14 460	* 15 000
Chile (b)	43 595	50 035	59 637	56 881	30 538
China	* 37 000	* 37 000	* 38 000	* 40 000	* 40 000
Australia					
Spodumene	173 635	222 101	245 279	239 528	197 482
World Total (Li Content)	17 100	18 300	18 800	18 400	12 700

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

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

Production of magnesite

tonnes (metric)

Country	2005	2006	2007	2008	2009
Austria	693 754	769 188	811 556	837 476	544 716
Greece	471 000	463 277	351 414	361 165	380 834
Netherlands (a)	285 336	293 006	* 245 000	316 264	183 256
Poland	55 300	63 000	65 000	60 000	47 000
Russia	* 2 600 000	* 2 600 000	* 2 600 000	* 2 600 000	* 2 600 000
Slovakia	920 100	941 100	957 000	806 500	477 600
Spain	556 129	520 646	463 850	* 440 700	* 434 000
Turkey	2 372 206	2 088 033	1 984 908	2 143 047	* 2 000 000
South Africa	54 800	73 300	80 700	83 900	* 84 000
Zimbabwe	893	939	1 814	2 549	449
Canada (b)	* 180 000	* 180 000	* 180 000	* 180 000	* 180 000
Guatemala	5 636	1 084	7 612	11 757	17 247
Brazil (c)	386 759	382 718	399 314	421 300	350 000
Colombia	38 000	40 000	42 000	38 000	* 35 000
China	15 440 000	13 640 000	* 14 000 000	* 15 600 000	* 15 000 000
India (d)	340 674	238 981	252 849	245 930	285 828
Iran (e)	94 850	187 764	112 229	115 987	* 116 000
Korea, Dem. P.R. of	* 1 200 000	* 1 200 000	* 1 200 000	* 1 200 000	* 1 200 000
Pakistan (f)	3 029	2 446	3 445	4 000	* 4 000
Philippines	2 413	3 630	3 600	3 976	3 872
Australia	631 572	482 027	343 424	* 150 000	* 372 000
World Total	26 300 000	24 200 000	24 100 000	25 600 000	24 300 000

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

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

Production of primary magnesium metal

tonnes (metric)

Country	2005	2006	2007	2008	2009
Russia	* 38 000	* 35 000	* 33 000	* 30 000	* 30 000
Serbia	—	* 1 500	* 2 000	* 1 500	* 1 500
Serbia and Montenegro	* 500	—	—	—	—
Ukraine	2 900	2 000	2 000	* 2 000	* 2 000
Canada	* 45 000	* 45 000	* 8 000	—	—
USA	* 40 000	* 40 000	* 40 000	* 40 000	* 40 000
Brazil	3 000	5 000	5 000	5 000	5 000
China	467 600	525 600	659 300	630 700	501 800
India	* 200	* 200	* 200	* 200	* 200
Israel	27 853	24 581	29 168	32 051	19 405
Kazakhstan (a)	20 000	21 000	* 25 000	* 25 000	* 25 000

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

Production of manganese ore

tonnes (metric)

Country	2005	2006	2007	2008	2009
Bulgaria	38 500	20 500	27 900	39 100	28 300
Georgia (a)	251 800	328 643	368 394	* 370 000	* 370 000
Hungary	50 000	50 000	51 000	49 579	43 000
Italy	632	...	...	...	...
Romania	72 000	60 107	49 350	43 590	* 40 000
Russia	* 44 000	* 44 000	* 44 000	* 44 000	* 44 000
Turkey	4 751	...	...	...	...
Ukraine (a)	2 260 000	1 606 000	1 720 000	1 447 000	* 1 000 000
Egypt	22 971	16 500	13 000	7 320	* 7 000
Gabon	2 752 987	2 978 972	3 333 800	3 250 000	2 000 000
Ghana	1 719 589	1 578 128	1 173 486	1 090 122	1 044 664
Ivory Coast	* 36 500	56 829	80 402	148 120	* 150 000
Morocco	10 000	2 500	41 628	102 285	51 800
Namibia	7 320	18 918	47 620	28 237	* 30 000
South Africa					
Metallurgical	4 599 289	5 201 162	5 982 190	6 798 187	4 564 855
Chemical	12 810	12 176	12 950	9 327	10 911
Sudan	...	—	400	—	500
Mexico	371 054	344 662	418 342	477 147	330 328
Brazil	3 200 000	3 128 000	1 866 000	2 400 000	1 700 000
Chile	39 786	37 169	26 808	5 096	1 642
China	* 7 500 000	* 8 000 000	* 10 000 000	* 11 000 000	* 12 000 000
India (b)	1 906 353	2 115 507	2 696 980	2 828 851	2 396 000
Iran (c)	114 708	70 471	103 441	115 199	* 115 000
Kazakhstan	2 207 700	2 531 100	2 482 000	2 485 000	2 457 400
Malaysia	—	6 500	56 500	536 675	468 963
Thailand	88 500	1 000	9 500	111 000	64 930
Australia	3 829 000	4 567 000	5 289 000	4 819 000	4 444 000
World Total	31 100 000	32 800 000	35 900 000	38 200 000	33 400 000

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

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

Production of mercury

kilograms

Country	2005	2006	2007	2008	2009
Finland	34 200	22 820	45 195	33 120	6 210
Russia	* 50 000	* 50 000	* 50 000	* 50 000	* 50 000
Algeria	300	—	—	—	—
Morocco	14 800	18 800	17 900	17 400	* 18 000
Mexico	* 6 000	* 8 000	21 355	58 482	36 696
USA	* 15 000	* 15 000	* 15 000	* 15 000	* 15 000
Argentina	—	—	3 483	1 027	9 468
Chile (a)	* 50 000	* 50 000	* 50 000	* 50 000	* 50 000
China	1 094 000	760 000	798 000	1 333 000	1 300 000
Kyrgyzstan	304 000	* 250 000	* 250 000	* 250 000	* 250 000
Tajikistan	* 30 000	* 30 000	—	—	—
World Total	1 600 000	1 200 000	1 300 000	1 800 000	1 700 000

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 (metric)

Country	2005	2006	2007	2008	2009
Finland	9 500	8 097	11 449	10 706	* 10 000
France (a)	* 20 000	* 20 000	* 20 000	* 20 000	* 20 000
Russia	* 9 000	* 11 000	* 12 000	* 10 000	* 9 000
Serbia	—	* 140	* 140	* 140	* 140
Serbia and Montenegro	* 140	—	—	—	—
Spain (a)	4 043	4 496	5 569	4 254	* 4 000
Egypt	...	...	200	50	* 50
Madagascar	546	1 071	1 349	1 233	* 1 200
South Africa	924	828	419	393	299
Sudan	...	...	...	66	100
Canada	* 17 500	* 17 500	* 17 500	* 17 500	* 17 500
Mexico	120	150	9 600	5 000	5 000
USA (b)(a)	78 000	110 000	97 000	84 000	* 90 000
Argentina	4 101	6 223	10 171	8 790	8 668
Brazil	* 4 000	* 4 000	* 4 000	* 4 000	* 4 000
China (c)	* 89 000	* 94 000	* 93 000	* 139 000	* 91 000
India (d)	2 116	1 411	1 242	1 206	1 243
Iran (e)	6 810	4 440	1 800	1 510	* 1 500
Korea (Rep. of) (f)	36 623	30 356	42 385	49 474	27 078
Malaysia (g)	4 544	5 152	6 118	5 593	4 323
Sri Lanka	1 800	2 600	3 224	2 364	2 347
Taiwan	8 608	4 841	3 387	3 179	557
Australia	737	—	—	—	—
World Total	300 000	330 000	340 000	370 000	300 000

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

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

Mine production of molybdenum

tonnes (metal content)

Country	2005	2006	2007	2008	2009
Armenia	3 030	4 090	4 385	4 472	4 365
Russia	* 4 800	* 4 800	* 4 800	* 4 800	* 4 800
Canada	7 935	7 723	6 819	8 229	9 210
Mexico	4 245	2 519	6 491	7 812	10 167
USA	58 000	59 800	57 000	55 900	* 50 000
Argentina	—	—	—	228	1 148
Chile	47 885	43 158	44 775	33 639	34 786
Peru	17 325	17 209	16 787	16 721	12 295
China	30 000	43 900	* 67 700	* 81 000	* 93 500
Iran (a)	2 476	3 574	8 933	6 597	* 6 600
Kazakhstan	...	400	800	* 800	* 800
Kyrgyzstan	* 250	* 250	* 250	* 250	* 250
Mongolia	1 188	1 404	1 978	1 900	2 410
Uzbekistan	* 575	* 600	* 600	* 600	* 400
World Total	178 000	189 000	221 000	223 000	231 000

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 (metric)

Country	2005	2006	2007	2008	2009
Norway	320 000	312 000	312 000	346 000	270 000
Russia (a)	* 1 000 000	* 1 000 000	* 1 000 000	* 1 000 000	* 1 000 000
Canada	745 000	719 000	690 000	646 000	513 000
Iran	6 000	4 000	75 000	...	...

Note(s)
(a) Nepheline concentrates

NICKEL

Characteristics

Nickel is hard, 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 extreme temperatures. 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 account for around 65 per cent of nickel consumption (International Nickel Study Group, 2010) 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 2009

World nickel mine production was 1 412 000 tonnes in 2009, a decrease of 169 000 tonnes or nearly 11 per cent from 2008. The world's largest nickel producer in 2009 was Russia with 18.5 per cent of world production. It was followed by Indonesia (14 per cent of world production), Australia (12 per cent) and the Philippines and Canada (with nearly ten per cent each). These top five producers together contributed 64 per cent of the total world nickel mine output.

Russia's production decreased by nearly two per cent in 2009 compared to 2008 and has fallen by 5.5 per cent between 2005 and 2009. Indonesia's output decreased by 7.5 per cent in 2009 but has increased by 35 per cent over five years. These contrast with a 17 per cent fall in production in Australia in 2009, reversing a small increase in 2008, and an overall 12 per cent decrease between 2005 and 2009. As a consequence, in 2009 Indonesia overtook Australia again to become the world's second largest producer.

Smelter/refinery nickel production has also decreased, with world production of approximately 1 347 000 tonnes, 47 000 tonnes (three per cent) less than in 2008. The largest producer was Russia with 19 per cent of production. China produced 18.8 per cent of the world's refined nickel despite only producing six per cent of the world's mine production. Other major producers of smelter/refinery nickel were Australia (11.1 per cent of world production), Japan (10.7 per cent) and Canada (8.7 per cent).

Prices

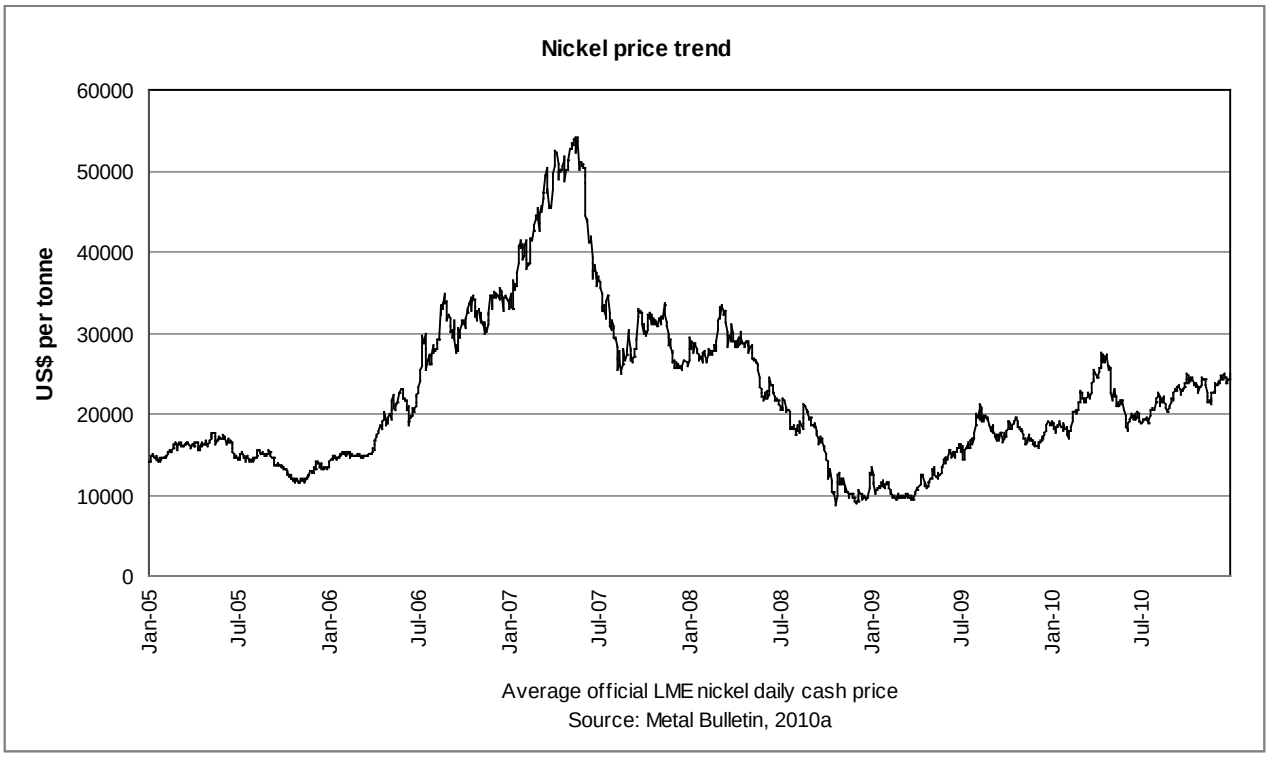
Nickel prices dipped below US$10 000 per tonne in early 2009; however, by mid 2009 prices were on an upward trajectory finishing 2009 at just under US$20 000 per tonne. The generally upward swing in prices continued in 2010 reaching US$24 120 per tonne by the end of December 2010. A peak price of US$27 600 per tonne was reached in April 2010, which was more than double the prices from April 2009 (Metal Bulletin, 2010a).

The global economic crisis, a general decline in primary nickel usage and the associated decrease in production were largely responsible for lowering the price of nickel during 2009. The factors responsible for the upward swing in prices include: increasing demand for stainless steel in China and the industrialised nations; a reduction in stockpiled nickel; and the use of innovative technologies to reduce production costs, e.g. bioheapleaching (Tollin, 2010).

Industry events in 2010

Nickel prices were hit hard by the economic downturn resulting in several mine closures and deferments of new projects. However, improvements in the global nickel market during late 2009 and 2010 encouraged a number of operations to restart and new projects to commence.

Despite ongoing strikes in the early stages of 2010, Canadian nickel producer, Vale Inco, restarted Furnace No 1 at its Copper Cliff smelter in Sudbury, Ontario, albeit at 50 per cent of rated capacity (Metal Pages, 2010). In February 2010, the company restarted full production at its Creighton nickel mine and boosted production at its Coleman nickel operation; the process material from both operations feed the Copper Cliff



smelter (Mineweb, 2010a). Xstrata recommenced production at both its suspended Sinclair nickel operation in Western Australia and at the Falcondo nickel mine in the Dominican Republic, as a result of improved nickel prices (Metal Bulletin, 2010b).

In May 2010, Mincor recommended the immediate re-opening of its Kambalda-based Miitel nickel mine in Western Australia. The mine is expected to produce 4500 to 5500 tonnes of nickel each year during a four-year production schedule. In addition, promising exploration results indicate a further resource at the mine of 148 000 tonnes at 2.7 per cent nickel, with the possibility of extensions to the south (Mincor, 2010). Chinese metal trader, Minmetals, conducted a significant review of its suspended Avebury nickel mine at a cost of US$2.7 million. If re-opened the Tasmania-based mine is expected to produce around 8500 tonnes of nickel per year; all of which will go to the Chinese Jinchuan Group refinery (Regan, 2010).

There were other positive signs of market recovery in 2010. For example, Rio Tinto acquired a mining permit for its nickel project in Sulawesi, Indonesia, worth around US$2 billion and expected to have an annual capacity of 46 000 tonnes of nickel (Mineweb, 2010b). The Lounge Lizard nickel sulphide deposit in Western Australia, owned by Kagara Ltd, produced its first nickel ore only 18 months after development began (Louthean, 2010). Underground operations recommenced at Poseidon Nickel's Mount Windarra project in Western Australia (MiningNews, 2010).

A number of joint-venture projects, mergers and investments also arose during 2010. Mining junior, Duluth Metals, formed a joint-venture with Chilean copper miner Antofagasta, centred on the Nokomis polymetallic project in Minnesota, which is estimated to contain significant amounts of copper, nickel, cobalt, platinum, palladium, gold and silver (Kosich, 2010a). Rusina Mining and European Nickel entered into a merger agreement, giving the new company nickel resources totalling 1.35 million tonnes and aiming to have a combined annual production of 44 900 tonnes (Batten, 2010). Sirius Resources acquired the Polar Bear nickel sulphide project in Western Australia, from Barrick, giving them 100 per cent ownership of the deposit (Winter, 2010). Norilsk Nickel confirmed it would invest around US$2.56 billion in developing two nickel deposits in the Zabaikalsky Territory of Russia, in a joint venture with the Russian state (Mining Journal, 2010).

According to metals analyst Greg Barnes of T.D. Newcrest, high pressure acid leach (HPAL) processing will be critical to the success of a number of nickel laterite projects planned to come on line between 2010 and 2013. Barnes predicted that the nickel market may be in deficit this year, i.e. demand may be greater than supply, due to a number of unforeseen circumstances such as mine strikes and reduced steel production. However, if HPAL works as well as advertised, too much nickel may be produced between 2010 and 2013 (Kosich, 2010b).

During 2010 bioheapleaching also proved to be an important process in the recovery of nickel from low grade sulphide ores. Talvivaara in Finland has an indicated resource of 642 million tonnes grading 0.23 per cent nickel, 0.51 per cent zinc, 0.13 per cent copper and 0.02 per cent cobalt. A large scale bioheapleaching plant was launched there in late 2010, with a full capacity of 50 000 tonnes of nickel per year expected by 2012. The process benefits from low capital expenditure, lower sulphur emissions compared to smelting, and the ability to treat complex low grade ores (Karpel, 2010).

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Mine production of nickel

tonnes (metal content)

Country	2005	2006	2007	2008	2009
Albania	700	90	2 197	1 349	550
Finland	3 400	3 000	3 600	6 200	1 600
Greece	20 400	21 700	21 200	18 600	9 600
Kosovo	—	—	—	3 655	3 956
Macedonia	7 800	10 900	15 000	15 000	12 000
Norway	342	320	378	377	336
Russia	277 200	277 000	279 800	266 800	261 900
Spain	5 380	6 398	6 630	8 136	8 029
Turkey	700	1 900	1 700	—	11 300
Ukraine	* 6 000	* 12 000	* 12 000	* 8 000	—
Botswana	28 212	26 762	22 844	28 940	29 616
Morocco	100	100	100	100	100
South Africa (a)	42 497	41 599	37 877	31 700	34 610
Zambia	—	—	—	800	1 500
Zimbabwe	9 220	8 825	8 582	6 354	4 858
Canada	198 932	232 948	254 915	259 651	136 594
Cuba	* 73 800	73 400	73 900	67 300	65 000
Dominican Republic	28 298	29 675	29 100	18 800	—
Brazil	74 198	82 492	58 317	67 116	* 67 000
Colombia	89 000	94 100	100 500	77 000	72 000
Venezuela	18 500	18 200	17 200	11 900	11 400
China	72 700	82 100	66 400	79 500	81 100
Indonesia	150 000	150 000	201 400	219 300	202 800
Kazakhstan	* 500	* 1 000	* 1 200	* 1 600	—
Philippines	22 560	64 705	91 367	80 645	137 350
Australia	189 000	185 000	184 000	200 000	166 000
New Caledonia	111 939	102 986	125 364	102 583	92 570
World Total	1 431 000	1 527 000	1 616 000	1 581 000	1 412 000

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

Smelter/refinery production of nickel

tonnes (metric)

Country	2005	2006	2007	2008	2009
Austria	1 000	900	900	500	700
Finland	39 159	47 469	55 000	51 963	40 800
France	12 684	13 700	14 800	13 700	13 900
Greece	19 235	17 700	18 668	16 640	8 269
Kosovo	—	—	—	5 777	6 365
Macedonia	8 141	10 942	15 000	15 000	12 000
Norway	85 374	82 257	87 600	88 700	88 577
Russia	269 400	275 700	268 800	261 500	255 500
Serbia	—	—	1 000	—	—
Ukraine	13 000	15 900	20 600	24 700	15 800
United Kingdom	37 600	36 750	34 050	40 800	17 800
South Africa	42 392	41 600	37 900	31 700	34 400
Zimbabwe	15 900	13 200	14 000	11 300	9 200
Canada	139 683	146 899	153 647	167 732	116 909
Cuba	39 100	* 42 000	* 41 500	35 600	33 000
Dominican Republic	28 668	29 675	29 130	18 742	—
Brazil	36 315	36 569	34 954	36 000	32 800
Colombia	52 749	51 137	49 312	41 638	51 802
Venezuela	18 500	18 200	17 200	11 900	11 400
China	97 800	136 600	199 300	200 300	253 800
Indonesia	7 300	14 474	18 532	17 566	12 550
Japan	163 243	149 954	161 200	156 500	143 500
Australia	121 000	116 000	114 000	108 000	150 000
New Caledonia	46 738	48 723	44 954	37 467	38 230
World Total	1 295 000	1 346 000	1 432 000	1 394 000	1 347 000

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

Production of perlite

tonnes (metric)

Country	2005	2006	2007	2008	2009
Armenia	49 963	* 50 000	* 50 000	* 50 000	* 50 000
Bulgaria	15 300	4 500	13 900	7 400	14 800
Georgia	* 5 000	* 5 000	—	—	—
Greece	1 075 129	* 1 100 000	1 100 000	1 000 000	862 935
Hungary	69 900	71 019	67 542	132 000	82 058
Italy	* 60 000	* 60 000	* 60 000	* 60 000	* 60 000
Russia	* 45 000	* 45 000	* 45 000	* 45 000	* 45 000
Slovakia	8 630	10 560	20 000	25 000	25 000
Turkey	156 935	* 160 000	* 160 000	* 160 000	* 160 000
Ukraine	38 200	36 400	* 36 000	* 36 000	* 36 000
South Africa	* 400	* 400	* 400	* 400	* 400
Mexico	91 724	81 719	54 405	43 180	51 395
USA	508 000	454 000	409 000	434 000	* 380 000
Argentina	21 991	25 146	35 838	26 545	21 802
China	* 700 000	* 700 000	* 700 000	* 700 000	* 700 000
India (a)	122	68	—	—	—
Iran (b)	30 051	30 050	47 422	* 47 000	* 47 000
Japan	* 240 000	* 240 000	* 230 000	* 230 000	* 230 000
Philippines	9 700	9 600	9 900	10 100	10 100
Thailand	14 500	22 000	6 400	7 000	* 7 000
Australia (c)	10 634	12 057	8 546	6 942	7 649
New Zealand	7 310	3 552	7 873	—	8 848

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

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

Production of crude petroleum

tonnes (metric)

Country	2005	2006	2007	2008	2009
Albania	448 040	518 686	563 189	577 301	576 576
Austria	933 040	856 270	853 549	861 639	905 031
Azerbaijan	22 214 200	32 185 900	42 523 200	42 074 700	48 302 800
Belarus	1 785 020	1 780 040	1 760 020	1 740 020	1 720 010
Bulgaria	30 000	27 500	25 700	23 000	23 800
Croatia	980 486	950 859	911 207	867 027	* 900 000
Czech Republic	306 000	259 000	240 000	236 000	217 000
Denmark	18 822 000	17 068 000	15 552 000	14 338 000	13 045 000
Estonia (a)	1 690 000	1 624 000	1 901 600	1 869 500	1 733 000
France	1 179 000	1 100 000	1 013 000	975 000	899 000
Georgia	66 600	63 506	63 850	51 660	51 483
Germany	3 815 173	3 515 401	3 415 374	3 053 998	2 800 063
Greece	135 000	93 000	80 000	66 000	87 000
Hungary	947 542	886 000	838 672	774 590	842 191
Italy	6 100 000	5 800 000	5 800 000	5 200 000	4 600 000
Lithuania	216 634	180 894	154 449	127 658	114 956
Netherlands	2 268 746	2 022 475	2 576 222	2 163 000	1 704 000
Norway	139 802 000	136 695 000	125 763 000	121 101 700	115 000 000
Poland	847 844	795 742	720 603	754 907	686 992
Romania	5 215 000	4 777 000	4 837 000	4 528 000	4 494 000
Russia	470 000 000	481 000 000	491 000 000	488 000 000	494 000 000
Serbia	—	654 288	639 089	636 383	663 005
Serbia and Montenegro	648 000	—	—	—	—
Slovakia	35 000	30 520	23 000	21 000	19 000
Spain	166 014	143 432	142 879	127 542	106 817
Turkey	2 280 764	2 175 353	2 131 288	2 222 594	2 489 914
Ukraine	4 413 800	4 506 000	4 459 000	4 328 000	3 960 000
United Kingdom	77 179 000	69 665 000	70 357 000	65 497 000	62 820 000
Algeria	84 821 000	85 036 000	86 100 000	85 600 000	77 600 000
Angola	61 200 000	69 700 000	84 300 000	92 200 000	87 400 000
Cameroon	4 200 000	4 400 000	4 200 000	4 300 000	3 700 000
Chad	9 100 000	8 000 000	7 500 000	6 700 000	6 200 000
Congo	12 566 100	13 402 300	11 091 800	11 768 000	14 100 000
Congo, Democratic Republic	1 230 000	1 230 000	1 105 000	995 000	816 000
Egypt	33 990 000	33 700 000	34 100 000	34 600 000	35 300 000
Equatorial Guinea	18 500 000	17 700 000	18 200 000	17 400 000	15 200 000
Gabon	11 700 000	11 700 000	11 500 000	11 800 000	11 400 000
Ghana	301 000	301 000	301 000	301 000	301 000
Ivory Coast	1 954 000	3 106 000	2 423 000	2 965 000	2 897 000
Libya	81 900 000	84 900 000	85 000 000	85 300 000	77 100 000
Mauritania	—	1 523 000	739 507	592 679	550 143
Morocco	32 300	11 200	11 100	9 000	9 300
Nigeria	125 347 780	120 000 000	114 200 000	103 100 000	99 100 000
Senegal	50 600	52 400	42 900	13 400	33 600
South Africa	1 113 500	721 000	502 000	403 000	270 000
Sudan	15 000 000	16 300 000	23 100 000	23 700 000	24 100 000
Tunisia	3 459 000	3 261 300	4 545 800	4 200 000	4 100 000
Barbados	47 861	47 133	40 253	39 760	* 39 000
Canada	127 400 000	131 600 000	136 500 000	135 700 000	134 300 000
Cuba	2 935 100	2 900 000	2 905 000	3 003 100	2 731 300
Guatemala	933 000	816 000	774 500	715 400	523 700
Mexico	194 390 000	190 410 000	179 450 000	163 220 000	135 600 000
Trinidad & Tobago	7 444 890	7 355 280	6 183 900	5 904 500	5 056 600
USA	318 580 000	315 576 700	315 244 529	309 499 555	334 525 662
Argentina	34 117 773	33 806 223	32 959 940	32 365 564	31 930 560
Bolivia	1 957 000	1 888 000	1 907 000	1 806 400	1 565 000
Brazil	88 600 000	93 600 000	94 800 000	98 500 000	105 000 000
Chile	171 000	150 000	132 000	137 000	192 000
Colombia	26 121 500	26 180 600	26 357 800	29 236 400	33 288 500
Ecuador	27 085 000	27 291 000	26 021 000	25 767 000	24 747 000
Peru	5 484 000	5 696 000	5 612 000	5 916 000	7 169 000
Suriname	707 000	774 000	877 500	951 000	945 300
Venezuela	151 000 000	144 200 000	133 900 000	131 600 000	124 800 000

Production of crude petroleum

tonnes (metric)

Country	2005	2006	2007	2008	2009
Afghanistan	...	...	* 3 000	* 3 000	* 3 000
Bahrain	1 822 000	1 790 000	1 721 000	1 636 000	1 603 000
Brunei	10 100 000	10 903 000	9 639 000	8 680 000	8 291 000
Burma (b)	1 124 000	1 088 000	1 076 000	973 000	984 000
China (c)	181 352 900	184 765 700	186 656 900	189 728 200	189 000 000
East Timor	136 000	119 000	57 000	—	—
India (b)	32 190 000	33 988 000	34 118 000	33 506 000	33 691 000
Indonesia	52 943 000	50 281 000	47 719 000	48 973 000	47 440 000
Iran	206 200 000	208 000 000	209 700 000	209 800 000	202 400 000
Iraq	90 000 000	98 100 000	105 300 000	119 300 000	121 800 000
Israel	3 114	3 500	11 700	2 200	2 010
Japan	834 000	818 000	876 000	899 000	840 000
Jordan	1 200	1 400	1 200	2 200	2 010
Kazakhstan	61 486 000	65 003 100	67 125 300	70 671 000	76 500 000
Kuwait (d)	129 300 000	132 700 000	129 900 000	137 300 000	121 300 000
Kyrgyzstan	100 000	100 000	100 000	71 000	77 300
Malaysia	33 600 000	31 900 000	32 600 000	32 900 000	31 500 000
Mongolia	28 000	52 000	117 000	162 000	257 000
Oman	38 600 000	36 750 000	35 350 000	37 700 000	38 500 000
Pakistan (e)	3 216 000	3 191 000	3 282 000	3 414 000	3 200 000
Philippines	794 000	728 000	815 000	902 000	1 150 000
Qatar	47 300 000	50 900 000	53 600 000	60 800 000	57 900 000
Saudi Arabia (d)	526 800 000	514 300 000	494 200 000	515 300 000	459 500 000
Syria	22 531 000	19 427 500	18 600 000	18 900 559	18 853 258
Taiwan	32 389	23 564	17 778	16 134	15 995
Tajikistan	21 700	23 700	25 900	25 800	26 200
Thailand	10 000 000	11 300 000	11 500 000	12 400 000	12 900 000
Turkmenistan	9 500 000	9 200 000	9 800 000	10 200 000	10 200 000
United Arab Emirates	129 000 000	139 000 000	136 400 000	139 500 000	120 600 000
Uzbekistan	5 400 000	5 400 000	4 900 000	4 800 000	4 500 000
Vietnam	18 519 000	16 800 000	15 920 000	14 850 000	16 300 300
Yemen, Republic of	19 132 000	17 429 000	15 300 000	14 100 000	13 104 442
Australia	21 439 000	20 605 000	21 567 000	21 569 000	21 510 000
New Zealand (f)	871 500	835 400	1 890 500	2 724 600	2 522 200
Papua New Guinea	2 191 000	2 290 000	2 153 000	1 950 000	* 1 950 000
World Total	3 873 000 000	3 895 000 000	3 884 000 000	3 906 000 000	3 714 000 000

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

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

Production of natural gas

million cubic metres

Country	2005	2006	2007	2008	2009
Albania	11	11	10	12	9
Austria	1 654	1 765	1 835	1 544	1 559
Azerbaijan	5 732	6 080	10 832	16 337	16 325
Belarus	228	219	201	203	205
Bulgaria	573	519	295	218	15
Croatia	2 384	2 714	2 892	1 229	1 238
Czech Republic	356	148	148	167	180
Denmark	9 909	9 861	8 760	9 564	7 590
France	1 089	1 167	1 023	925	877
Georgia	15	21	18	14	12
Germany	19 143	19 798	18 075	16 547	15 554
Greece	16	* 16	21	14	11
Hungary	3 041	3 254	2 653	2 703	2 748
Ireland, Republic of (a)	570	500	519	506	414
Italy	11 977	11 000	9 700	9 300	7 900
Netherlands	74 460	73 300	72 431	79 325	74 659
Norway	84 702	87 600	89 700	99 200	103 500
Poland	5 742	5 651	5 653	5 382	5 537
Romania	12 637	12 422	11 981	11 520	10 900
Russia	641 000	656 000	653 000	664 000	584 000
Serbia	—	280	274	282	283
Serbia and Montenegro	282	—	—	—	—
Slovakia	211	135	195	111	114
Slovenia	6	4	3	3	3
Spain	174	118	42	46	20
Turkey	484	307	839	894	660
Ukraine	20 787	21 094	21 104	21 444	24 189
United Kingdom	93 505	84 748	76 970	74 936	62 890
Algeria	89 235	88 209	84 827	86 505	81 400
Angola	650	680	830	680	690
Congo	6 801	7 512	7 276	7 351	* 7 000
Egypt	42 500	54 700	55 700	58 900	62 700
Equatorial Guinea	3 800	3 800	4 500	8 300	* 8 000
Gabon	151	155	167	* 160	* 160
Ivory Coast	2 200	2 200	1 574	1 300	* 1 300
Libya	11 300	13 195	15 280	15 900	15 300
Morocco	40	56	61	50	41
Mozambique	2 400	2 700	2 800	3 100	3 300
Nigeria	22 400	28 500	32 500	32 825	24 900
South Africa	1 900	1 700	1 600	1 500	1 200
Tunisia	2 873	2 394	2 285	2 042	* 2 000
Barbados	24	23	* 21	* 21	* 21
Canada	176 510	176 808	174 334	167 515	155 966
Cuba	743	1 091	1 218	1 161	1 155
Mexico	45 000	51 600	54 000	54 000	58 200
Trinidad & Tobago	33 270	40 082	42 259	41 842	42 805
USA (b)	511 000	524 000	540 000	574 000	593 000
Argentina	51 573	51 778	51 007	50 509	48 416
Bolivia	12 536	13 433	14 301	14 895	12 786
Brazil	12 200	12 700	12 710	15 510	13 370
Chile	2 394	2 199	2 015	1 828	1 889
Colombia	6 700	7 000	7 500	9 100	10 364
Ecuador	255	283	310	255	* 300
Peru	1 586	1 784	* 2 700	* 3 200	* 3 300
Venezuela	27 400	31 500	32 100	29 200	27 900
Afghanistan	* 50	* 50	* 50	155	142
Bahrain	12 692	13 436	11 433	12 320	12 475
Bangladesh (c)	13 783	14 921	15 920	17 015	18 511
Brunei	12 000	12 135	11 718	11 665	10 733
Burma (d)	11 443	13 032	13 385	11 375	12 120
China	49 320	58 553	69 200	80 300	85 200
East Timor	* —	4 132	4 826	5 986	5 063
India (d)	32 202	31 747	32 417	32 849	46 474
Indonesia	84 571	80 501	76 703	74 128	81 810

Production of natural gas

million cubic metres

Country	2005	2006	2007	2008	2009
Iran	103 500	108 600	111 900	116 300	131 200
Iraq	1 450	1 450	1 460	1 880	1 149
Israel	1 656	2 313	2 758	3 436	2 825
Japan	3 263	3 302	3 708	3 735	3 539
Jordan	242	251	220	250	220
Kazakhstan	14 023	26 382	29 562	32 889	35 900
Kuwait (e)	12 300	12 410	12 060	12 700	12 500
Kyrgyzstan	30	20	10	17	15
Malaysia	59 880	59 640	60 780	60 820	58 540
Oman	19 600	25 657	26 107	25 968	24 800
Pakistan (c)	38 085	39 645	40 028	41 178	43 000
Philippines	3 285	3 077	3 689	3 883	3 910
Qatar	45 800	50 700	63 200	76 600	89 300
Saudi Arabia (e)	71 240	73 461	74 420	80 440	77 500
Syria	6 300	8 272	7 825	7 574	7 948
Taiwan	548	463	417	357	351
Tajikistan	27	18	17	16	20
Thailand	23 676	24 302	25 812	27 559	26 347
Turkmenistan	57 000	60 400	65 400	66 100	36 400
United Arab Emirates	47 790	48 790	50 290	50 240	48 800
Uzbekistan	59 700	55 400	59 100	63 800	61 400
Vietnam	6 440	7 000	7 080	7 944	8 010
Australia	37 129	38 885	39 955	38 256	42 345
New Zealand	3 862	3 983	4 310	3 995	4 113
Papua New Guinea	154	153	126	148	* 150
World Total	2 891 000	3 002 000	3 059 000	3 170 000	3 093 000

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

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

Production of phosphate rock

tonnes (metric)

Country	2005	2006	2007	2008	2009
Finland	822 987	857 922	830 989	780 000	660 405
Russia	11 317 400	10 812 800	10 936 500	9 810 200	9 537 800
Algeria	902 300	1 510 233	1 800 025	1 805 000	1 017 000
Burkina Faso	* 2 400	* 2 400	* 2 400	* 2 400	* 2 400
Egypt	2 620 900	2 176 900	2 504 000	3 178 900	3 708 200
Morocco	28 788 000	27 097 000	27 834 000	24 861 000	18 307 000
Senegal	1 451 000	584 000	691 300	645 000	948 600
South Africa	2 576 885	2 628 714	2 555 723	2 286 794	2 237 128
Tanzania	7 096	2 881	8 261	28 684	18 000
Togo	1 047 893	1 156 500	750 100	842 508	725 547
Tunisia	8 220 400	7 838 000	8 002 000	7 691 700	7 409 000
Zimbabwe	71 505	65 838	46 106	21 051	32 100
Canada	888 000	530 000	682 000	983 000	901 388
Mexico	350	7 500	47 721	969 094	1 421 823
USA	36 100 000	30 100 000	29 700 000	30 200 000	* 27 200 000
Brazil (a)	5 631 000	5 932 000	6 185 000	6 730 000	5 600 000
Chile	20 363	13 836	25 073	41 186	13 292
Colombia	* 43 000	* 43 000	* 24 000	* 48 000	* 48 000
Venezuela	392 000	400 000	* 400 000	* 400 000	* 400 000
China	30 444 900	38 959 500	45 417 000	50 740 600	60 208 900
Christmas Island (b)(c)(d)	757 013	724 278	703 719	* 700 000	485 000
India (e)	2 049 277	1 586 843	1 849 188	1 758 982	1 450 000
Iran	284 166	351 656	252 903	* 250 000	* 250 000
Israel	3 236 000	2 949 000	3 069 000	3 088 000	2 697 000
Jordan	6 374 725	5 804 991	5 552 000	6 266 000	5 280 693
Kazakhstan	1 534 100	1 059 300	1 044 900	2 470 600	1 204 700
Korea, Dem. P.R. of	* 100 000	* 100 000	* 100 000	* 100 000	* 100 000
Pakistan (d)	2 687	2 996	3 350	* 3 000	* 3 000
Philippines					
Phosphate rock	2 178	1 963	1 961	2 271	2 257
Guano	140	213	209	254	251
Sri Lanka	41 978	42 159	40 128	41 947	36 347
Syria	3 500 000	3 664 000	3 678 000	3 221 379	2 466 150
Thailand	3 020	900	3 550	3 675	* 3 500
Uzbekistan	468 000	573 000	599 500	700 000	800 000
Vietnam	1 024 200	1 232 400	1 522 700	2 100 700	1 896 300
Australia	1 935 630	2 083 454	2 131 045	2 156 848	1 962 893
Nauru (b)	* 18 000	* 84 000	* 200 000	497 469	146 816
World Total	153 000 000	151 000 000	159 000 000	165 000 000	159 000 000

Note(s)

(1) In addition to the countries listed, Indonesia and Nigeria are believed to produce phosphate rock

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

PLATINUM GROUP METALS

Characteristics

Platinum is a rare, silvery greyish-white metal that is denser than gold, corrosion resistant, and highly ductile. Platinum is one 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 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 minerals 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 40 per cent of platinum and 70 per cent of palladium produced in 2010 was used in catalytic converters in vehicle exhaust systems where they help to reduce pollutants. The PGM are also used in a wide range of industrial applications, in jewellery and as a form of investment (exchange-traded funds, bars, ingots, coins, etc).

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 and palladium are 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. Demand for palladium jewellery is increasing and it is now the fourth most important use of the metal after autocatalysts, electronics and investment.

Platinum is becoming increasingly important in the electronics industry where the metal is used in hard disc drives and LCD monitors. Palladium is used mainly in multi-layer ceramic capacitors (MLCC) but also in hybrid integrated circuits (HIC) and plating for connectors inside computers.

The chemical industry uses a large amount of platinum as a catalyst in the manufacture of fertilisers, explosives, polymers and in oil refining. Platinum is also used within the pharmaceutical industry in anti-cancer drugs. A growing and potentially major 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 2009

Net demand for platinum fell 8.5 per cent in 2009 to 5.64 million troy ounces. Demand from the automotive and industrial sectors both decreased significantly, although demand from the jewellery industry and identifiable physical investment demand for platinum both increased. Net palladium demand fell by five per cent to 6.34 million troy ounces (Johnson Matthey, 2010a).

World production of platinum decreased in 2009 for the third consecutive year with a total output of approximately 176 000 kilograms, four per cent lower than in 2008 and a 16 per cent decrease compared to peak global production of 208 000 kilograms in 2006. Palladium production also decreased with a world total of 181 000 kilograms, a drop of three per cent from 2008 and 13 per cent lower than the 209 000 kilograms produced in 2006. Production of the other platinum group metals, iridium, osmium, rhodium and ruthenium, rose to 72 000 kilograms compared to 70 000 kilograms in 2008.

South Africa dominated the world's platinum production with 80 per cent of global output provided by the Bushveld complex. Russia followed with 11 per cent of world production, Zimbabwe provided four per cent and Canada three per cent.

Russia was the largest palladium producer in 2009 with an output that accounted for 44 per cent of global production. South Africa provided 41 per cent, followed by the USA with seven per cent and Canada with four per cent.

In South Africa, platinum production declined in 2009 by four per cent compared to 2008. Palladium production decreased marginally by 0.6 per cent compared to 2008. As in 2008, the operational climate was extremely difficult with the industry hit by safety stoppages, strike action, smelter power outages and geological issues, while production was also affected by the closure of a number of uneconomic shafts and pits (Johnson Matthey, 2010a).

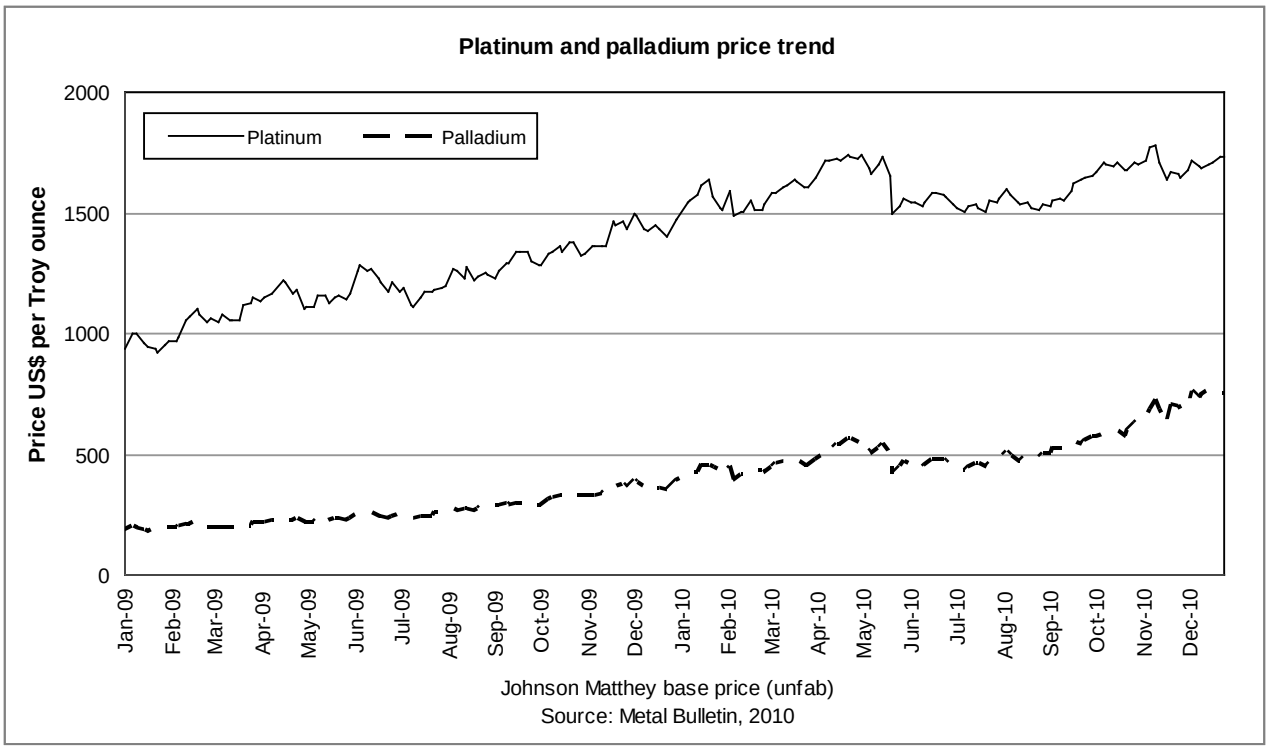
Russia's platinum production increased very slightly in 2009, whereas palladium output decreased, but only by 0.6 per cent compared to 2008. Both platinum and palladium production increased in the USA in 2009 by seven per cent and six per cent respectively.

Canada showed a significant decrease in platinum and palladium production with outputs down by 41 per cent each compared to 2008. This decrease was due to the temporary closure of North American Palladium's Lac des Iles Mine at the end of 2008. Production has since restarted at this operation, in response to rising prices, and supplies should increase in 2010 (Mining Journal, 2010a).

Platinum and palladium production from Zimbabwe both increased by 25 per cent in 2009 compared with 2008. This increase was due to the continuation of expansion programmes at both operating mines on the Great Dyke (Johnson Matthey, 2010a).

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.



Prior to its use in catalytic converters, the price of platinum hovered in the region of US$400 per troy ounce. However, the significant increase in demand, caused by legislation requiring pollution from cars to be reduced, resulted in prices rising to around US$2200 per troy ounce by early 2008. Although the global financial crisis caused a dramatic fall in prices, to about US$900 per troy ounce, there has been a noticeable recovery with prices reaching US$1476 per troy ounce by the end of 2009.

The price trend over 2010 showed a general increase driven by strong investment demand, a weakening US dollar and signs of a recovering global economy (Johnson Matthey, 2010b). The overall average price for 2010 was US$1612 per troy ounce, compared to an average of US$1210 per troy ounce in 2009, an increase of 33 per cent.

The platinum price at the start of 2010 was US$1540 per troy ounce and rose to a high of US$1635 per troy ounce in January, following the launch of exchange traded funds backed by improving physical demand. Prices fell to a low of US$1490 per troy ounce in the first week of February, the lowest price seen in 2010, as worries over the Greek sovereign debt caused investors to move to safer options (Johnson Matthey, 2010b). Prices began to increase again in March and April due to a weaker US dollar, recovery in the automotive sector and a positive response to the Greek Eurobond offer (Johnson Matthey, 2010b). Although prices softened slightly at the beginning of May they reached US$1730 per troy ounce by the middle of the month. This was followed by a sharp price correction to US$1497 per troy ounce as investment demand fell and there were fears of a double dip recession (Harvey, 2010).

Prices ranged between US$1500 per troy ounce and US$1600 per troy ounce throughout June, July and August, but then rose steadily throughout September and October due to a weaker US dollar and rising gold prices. Prices hit the highest point of the year in November when they reached US$1780 per troy ounce, but this was followed by a fall to US$1634 per troy ounce, due to a strengthening US dollar and concerns about how new measures to curb inflation in China will affect demand (Frei, 2010). Prices recovered throughout December and finished 2010 at US$1735 per troy ounce, a 13 per cent increase compared to the start of the year.

Palladium also performed strongly in 2010. Prices increased steadily for the first five months due to strong investment demand and recovery in the automotive sector. As with platinum, palladium experienced a sharp price drop in May due to concerns over the global economic recovery (Johnson Matthey, 2010b). Prices rose significantly following this and reached US$594 per troy ounce at the beginning of October, the highest price seen since the peak in March 2008. Other than a small price drop in November, palladium prices continued to rise for the rest of year and ended 2010 on US$757 per troy ounce, 79 per cent higher than the beginning of the year.

Industry events in 2010

The platinum industry in South Africa experienced a series of shaft closures, safety stoppages and strikes. As a result, supplies of platinum and rhodium are expected to decline slightly in 2010 although palladium supplies are forecast to increase. Increases in output for 2010 are expected from both Russia and Zimbabwe, but a decrease is expected from North America (Johnson Matthey, 2010b).

Production from Anglo Platinum, the world's largest producer of PGMs, decreased in 2010 due to the closure of three shafts in 2009. Maintenance work at the company's Polokwane and Waterval smelters caused a build up in unprocessed concentrates resulting in a decline in refined output in the first half of 2010 (Johnson Matthey, 2010b). However, CEO Neville Nicolau stated that the group planned to increase production by 100 000 troy ounces each year for the next four years (Mineweb, 2010).

The world's second largest platinum producer, Impala Platinum, reported increased production from its South African Rustenburg lease area. The focus here remains on-reef

development at current shafts and development at the project shafts. Number 20 Shaft is on track for first production at the beginning of 2011 (Implats, 2010).

Lonmin Plc, the world's third biggest platinum producer, had smelter problems with its Number One furnace, which was out of action for two months. This, however, did not prevent the company maintaining its platinum sales forecast for the financial year (Johnson Matthey, 2010b). Production from the company's Marikana Mines increased slightly in 2010 due to improved recoveries and a ramp up in production at the Hossey and Saffy shafts balancing losses caused by shaft closures in 2009 (Lonmin, 2010).

South African-based Aquarius Platinum announced in May that its Everest concentrator had been recommissioned three months ahead of schedule (Aquarius Platinum, 2010). By the end of June 150 000 tonnes of ore had been processed, yielding 8000 troy ounces of platinum (Johnson Matthey, 2010b). In July the company announced that it would undertake a critical and comprehensive review of the mine plan, safety procedures and practices at the Blue Ridge Platinum Mine, following two fatal accidents that occurred at the mine. Operations were suspended for a two week period (Mining Journal, 2010b).

Northam Platinum announced in June that it had completed an optimisation exercise on the feasibility study for its Booysendal project in the Bushveld Complex. The results indicated that the start-up of production could be accelerated, the mining layout could support a higher rate of production and that this would result in lower unit operating costs (Northam Platinum, 2010a).Workers at the company's Zondereinde Mine in South Africa went on strike in September following a pay dispute. Operations resumed in the middle of October but the six-week strike resulted in revenue losses of approximately R380 million (Northam Platinum, 2010b).

In September US platinum producer Stillwater Mining Company bought Toronto-based Marathon PGM Corp for US$1.18 million. Stillwater acquired the Marathon PGM-copper project in Ontario as part of this deal, significantly increasing the company's reserve base and production scale (Mining Journal, 2010c). The company also gave the go ahead for two mine resource delineation and development projects within the confines of the Stillwater Complex in Montana. These projects are covered by existing permits and can be serviced from mine infrastructure already in place (Marketwire, 2010). North American Palladium's Lac des Iles Mine in Ontario restarted in April after being placed on care and maintenance in October 2008 due to declining palladium prices. The mine is expected to produce 140 000 troy ounces of palladium per year (Hill, 2010).

Platinum Australia's Smokey Hills Mine in South Africa has been affected by industrial action, geological difficulties and power cuts during 2010, which interrupted the ramp-up of production at the mine (Johnson Matthey, 2010b). The company has announced the results of the Definitive Feasibility Study (DFS) for its Kalahari Platinum project in South Africa. The DFS Report shows the project to be commercially and technically viable and able to generate a return of about 25 per cent on the base case assumptions based on mining seven of the eight known deposits (Platinum Australia, 2010a). Platinum Australia also announced an updated resource estimate for the Rooderand Platinum project in South Africa, increasing the resource to 28.83 million tonnes at 5.55 grams per tonne platinum+palladium+rhodium+gold (Platinum Australia, 2010b).

South Africa based Wesizwe Platinum has struck a deal with a Chinese consortium to develop the Frischgewaagd-Ledig project, which is expected to produce 350 000 troy ounces PGM per year (Reuters, 2010). Pan African Resources plc released an upgraded resource estimate for the Phoenix platinum project in South Africa. The total resource has increased by 15.8 per cent to 469 000 troy ounces platinum group metals and in situ grade has increased by 2.6 per cent to 3.15 grams per tonne PGM (Pan African Resources, 2010).

In January, Duluth Metals signed a binding heads of agreement with Antofagasta plc on a joint venture development of the large-scale copper-nickel-PGM Nokomis Project in north-east Minnesota (Duluth Metals, 2010a). Highlights from recent drilling include a hole which returned 90 feet at 1.123 grams per tonne total precious metals (TPM; platinum+palladium+gold) including a 30 foot section grading 1.805 grams per tonne TPM (Duluth Metals, 2010b).

Noront Resources continued exploration activities at its McFaulds Lake project in Ontario during 2010. Recent drilling intersected 87.4 metres with average grades of 1.8 grams per tonne platinum and 3.17 grams per tonne palladium. Noront is hoping to complete a feasibility study on the project in the second half of next year (Johnson Matthey, 2010c).

In the first half of 2010, Colossus Minerals was granted mining and environmental licenses for its Serra Pelada gold-platinum project in Brazil and development activities began in September (Colossus Minerals, 2010). INV Metals Inc. announced that a diamond drill programme has commenced at its Rio Novo North gold, platinum and palladium target in Brazil. According to Chief Executive Robert Bell, the results of the soil geochemistry are encouraging so far and confirm the potential for the Rio Novo North area to host a gold-platinum-palladium deposit similar to that of Serra Pelada (INV Metals, 2010).

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Mine production of platinum group metals

kilograms (metal content)

Country	2005	2006	2007	2008	2009
Russia					
Platinum	21 290	21 319	20 979	18 682	18 739
Palladium	88 819	89 698	88 252	79 974	79 520
Other platinum metals	* 15 500	* 15 600	* 14 500	* 14 500	* 14 500
South Africa					
Platinum	168 749	168 125	165 835	146 141	140 819
Palladium	84 908	86 265	86 461	75 537	75 118
Other platinum metals	58 218	53 138	58 623	54 089	55 456
Zimbabwe					
Platinum	4 833	4 998	5 086	5 495	6 849
Palladium	3 879	4 022	3 999	4 274	5 354
Other platinum metals	862	875	881	928	1 190
Canada					
Platinum	* 7 900	* 8 000	* 8 100	* 7 970	* 4 670
Palladium	* 13 800	* 14 000	* 14 100	* 13 800	* 8 140
Other platinum metals	* 900	* 900	* 900	* 900	* 530
USA					
Platinum	3 919	4 292	3 857	3 577	3 826
Palladium	13 312	14 401	13 312	11 944	12 659
Colombia	1 082	1 438	1 526	1 370	929
Australia					
Platinum	58	...	...	...	...
Palladium	603	(a) 959	(a) 742	(a) 710	(a) 726
World Total	489 000	488 000	487 000	440 000	429 000

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_2O content)

Country	2005	2006	2007	2008	2009
Belarus	4 928 000	4 605 300	4 971 600	4 967 000	2 485 400
Germany					
Potassic salts	3 663 829	3 624 977	3 636 504	3 280 467	1 825 139
Russia	6 265 600	5 274 100	6 373 100	5 935 400	3 690 900
Spain					
Chloride	494 594	493 189	531 739	472 952	481 455
Ukraine	* 13 000	* 8 000	* 12 000	* 11 000	* 10 000
United Kingdom					
Chloride	439 200	427 000	430 000	403 800	360 000
Canada					
Chloride	10 140 000	8 528 000	11 426 000	10 379 000	4 318 000
USA					
Potassic salts	1 200 000	1 100 000	1 100 000	1 100 000	* 840 000
Brazil					
Chloride	404 871	403 080	471 333	383 000	430 000
Chile					
Chloride	547 000	515 000	533 000	578 000	594 000
China	1 450 000	1 571 900	1 822 600	1 980 000	2 100 000
Israel					
Chloride	2 224 200	2 187 000	2 146 000	2 134 000	2 446 200
Jordan	1 097 487	1 020 000	1 090 000	1 200 000	1 199 400
World Total	32 900 000	29 800 000	34 500 000	32 800 000	20 700 000

RARE EARTH ELEMENTS

Characteristics

The rare earth elements (REE) are a group of 17 chemically similar metallic elements, including scandium, yttrium and the lanthanides. Scandium and yttrium are considered REE as they have similar chemical and physical properties. REE can be divided into two groups: the light REE (LREE e.g. neodymium, lanthanum, cerium) and the heavy REE (HREE e.g. dysprosium, terbium). As refined metals the REE are lustrous, iron grey to silvery in appearance. They are characteristically soft, malleable, ductile and typically reactive. The electron structure of REE gives them some unusual magnetic and optical properties.

REE do not occur naturally as metallic elements. REE occur in a wide range of mineral types including halides, carbonates, oxides and phosphates. The REE are largely hosted by rock-forming minerals where they substitute for major ions. Around 200 minerals are known to contain REE, although a relatively small number are, or may become, commercially significant. The vast majority of resources are associated with just three minerals, bastnäsite, monazite and xenotime.

REE mineral deposits occur in a broad range of igneous, sedimentary and metamorphic rocks. Environments in which REE are enriched can be broadly divided into two categories: primary deposits associated with igneous and hydrothermal processes and secondary deposits concentrated by sedimentary processes and weathering. The most commercially important REE deposits are associated with magmatic processes and are found in, or related to, alkaline igneous rocks and carbonatites.

Uses

REE have a diverse range of specific applications in a wide range of consumer electronics, in environmental technologies and in military applications.

Significant amounts of REE are used in catalysts. Cerium in particular is essential in automotive catalytic converters, which transform the primary pollutants in engine exhaust gases into non-toxic compounds. Lanthanum is used in fluid cracking catalysts, which are used in the process of refining crude oil, transforming the heavy molecules into lighter compounds that make up petrol and other fuels such as gas, jet fuel and diesel.

An increasingly important use of REE, particularly neodymium, is in high-strength permanent magnets. These magnets are important for many consumer products such as hard disk drives and in 'green', carbon-reducing technologies including the motors in hybrid vehicles and wind turbines. Dysprosium and terbium are also used in permanent magnets to prevent them from losing their magnetism at high temperatures.

REE have major applications in metallurgical alloys, for example in superalloys and hydrogen storage. REE, especially lanthanum, are also essential in nickel-metal-hydride (NiMH) rechargeable batteries that are important in products such as hybrid cars.

REE are also key components of phosphors used in televisions, computer screens and any other visual display devices that requires cathode ray tube, liquid crystal display or plasma display panel technologies. REE phosphors are also important in energy efficient lighting and the manufacture of lasers and fibre optics.

The glass industry is a major consumer of REE where they are used in the manufacture of specialised lenses, as decolourising agents and dyes as well as for polishing. Cerium is especially suitable as a polishing agent, as it removes glass by both chemical dissolution and mechanical abrasion, making it more efficient than other agents such as silica and zirconia. The majority of polished glass products, for example mirrors, television faceplates and cathode ray tubes are finished using cerium oxide (Haxel et al., 2002).

REE are also commonly used in ceramics. The addition of cerium and yttrium oxides improve both the strength and toughness of structural ceramics. REE are also used in ceramic capacitors and refractories.

REE also have a variety of uses in nuclear, medical, and defence applications. As research and technology continue to advance many more applications for REE are being developed and discovered, especially in the areas of energy conservation and efficiency and environmental protection, for example magnetic refrigeration and fuel cells.

World production in 2009

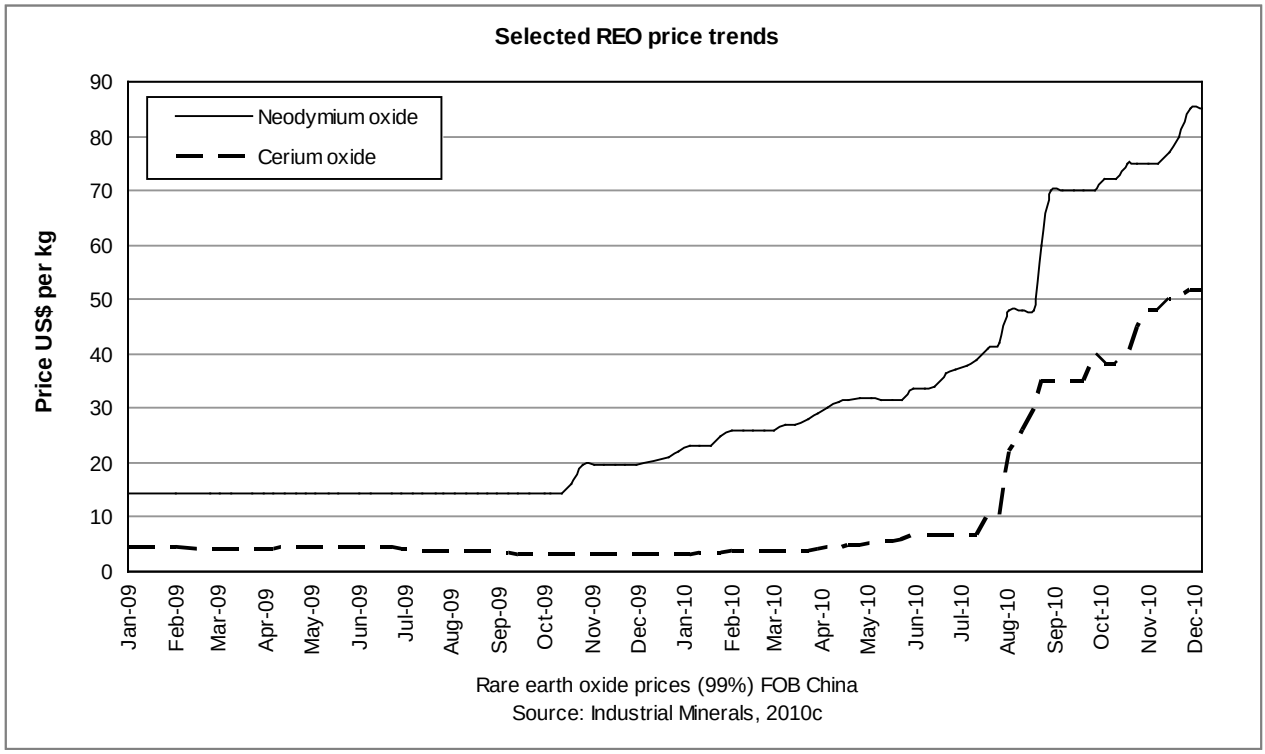
The only countries known to be actively mining REE are China, Russia, India, Brazil and Malaysia. Since the closure of Mountain Pass mine in 2002, the USA has not mined REE ore but has been producing REE products using stockpiled material.

Total estimated world production of rare earth oxide (REO) in 2009 was approximately 123 000 tonnes, four per cent less than the estimated 2008 production of 128 000 tonnes. World production has more than doubled in the last 15 years. Peak production was in 2006 with over 137 000 tonnes REO.

China has dominated rare earth production since the 1990s when other producers were unable to compete with low-priced Chinese exports. China produces REO primarily from the Bayan Obo deposit in Inner Mongolia as a by-product of iron ore mining, but also from bastnäsite-bearing carbonatites in Sichuan and Mianning, and the HREE-rich ion adsorption clays in southern China. China produced approximately 120 000 tonnes REO in 2009, accounting for over 97 per cent of global supply. This is a slight decrease from the estimated 125 000 tonnes produced in 2008 and almost a ten per cent drop compared to peak production of 133 000 tonnes in 2006.

Russia produces rare earths from loparite deposits in the Kola Peninsula. The loparite concentrate is extracted by the Lovozerskaya Mining Company and processed to rare earth chlorides, and then rare earth carbonates by Solikamsk Magnesium Works (SMW). Production for 2009 has been estimated at 2500 tones REO compared to reported production of 2470 tonnes in 2008. This accounts for about two per cent of global production. As with China, peak production from Russia was in 2006, with a total of 2935 tonnes (Chegwidden, pers comm).

Rare earths are produced in Brazil from heavy mineral sands by Indústrias Nucleares do Brasil (INB). An estimated 650 tonnes of REO was produced in 2009 accounting for about 0.5 per cent of global production. India has produced monazite from beach sands in the past but this largely ceased in 2004. The country also produces small quantities rare earth compounds from re-working thorium stockpiles.



Rare earth oxide prices (99%) FOB China
Source: Industrial Minerals, 2010c

The only other reported mine production of rare earths is from Malaysia which produced about 20 tonnes of REO from monazite in 2009, a significant drop from the 580 tonnes produced in 2006. Rare earths are thought to be produced in other countries but reliable estimates of quantities are difficult to obtain.

Prices

As with many minor metals, there are no exchanges on which rare earths are traded. Both the metals and their oxides are sold by specialist rare earth trading companies. The price of rare earths also depends on the purity level, which is largely set by the specifications for each application.

REE prices have fluctuated significantly since the 1950s, largely as a result of the supply/demand balance, related to environmental legislation and economic factors such as inflation and energy costs.

Production of rare earths increased between 1990 and 2006 but prices declined due to significant amounts of lower priced Chinese REE and supply exceeding demand. The price of most REE rose significantly in 2007 as a result of increased Chinese consumption and China's enactment of export controls. In response to the rising price, Mountain Pass Mine, USA, restarted processing stocks of REE concentrate (Papp et al., 2008). The rate of increase accelerated following this, peaking in the first half of 2008. Of the LREE oxides praseodymium and neodymium showed the largest rises, both increasing in price by approximately 700 per cent between 2002 and 2008. In addition to being rarer, the HREE became increasingly important in industry during the 2000s with the prices of dysprosium oxide and terbium oxide increasing by 500 per cent and 300 per cent respectively between 2002 and 2008.

As with many resource-based sectors, the REE industry was deeply affected by the recession. During the second half of 2008 many industries began to use existing inventories to lower costs. This caused REE prices to decrease significantly; for example terbium fell to US$360 per kilogram, a decrease of more than 50 per cent from its peak of US$740 per kilogram in 2008. Praseodymium and neodymium prices also fell dramatically in the second half of 2008 before stabilising at that level for most of 2009. REE prices began to recover during the last quarter of 2009 but were still a long way off pre-recession prices.

Prices for all REO increased throughout the first quarter of 2010, largely driven by an increase in Japanese imports and growing demand for permanent magnet applications. The biggest increases were for neodymium, praseodymium, dysprosium and terbium (Watts, 2010a). Neodymium, for example, averaged US$25 per kilogram in the first quarter of 2010 compared to US$14.5 per kilogram in the first quarter of 2009.

During the second quarter of 2010 lanthanum and cerium prices continued to rise gradually and by early July had reached US$7.7 per kilogram and US$6.6 per kilogram respectively, compared to US$5.6 per kilogram and US$3.4 per kilogram at the beginning of the year. Neodymium and praseodymium were both trading at around US$37 per kilogram during this time.

In the middle of July, China announced that they would be cutting their export quotas for rare earths by 70 per cent for the second half of 2010 to 7976 tonnes, taking the total to 30 258 tonnes for the year, compared to 50 145 tonnes in 2009 (Watts, 2010b). This sparked a dramatic price increase for all RE oxides and metals. Prices were particularly affected for the lower value light REE, especially cerium and lanthanum. Chinese producers have to pay for export quotas so have focused on selling the high value heavy rare earths in order to maximise profits. This has created a supply squeeze for the LREE (Industrial Minerals, 2010a). Between the end of July and beginning of September, cerium oxide prices rose from US$6.7 per kilogram to US$35 per kilogram, an increase of over 400 per cent. Lanthanum increased by more than 300 per cent over the same time period with neodymium and praseodymium showing less dramatic, but significant, rises of

85 per cent (US$37.7 per kilogram to US$70 per kilogram) and 47 per cent (US$37.5 per kilogram to US$65 per kilogram) respectively. Prices plateaued during the latter part of September and early October but rose steadily for the rest of the year as supplies remained tight and uncertainties persisted over China's export quotas for 2011. Lanthanum and cerium finished the year on US$52 per kilogram and US$51 per kilogram respectively, increases of 881 per cent and 1525 per cent compared to the beginning of 2010. Neodymium and praseodymium prices also showed dramatic increases, both finishing the year on US$85 per kilogram, increases of 305 and 325 per cent respectively compared to the start of 2010.

Prices for 2011 depend on the level of Chinese export quotas. Reports have indicated that China will maintain similar or lower quotas than 2010. This could make the supply problem more serious due to depletion of stock and increased demand (Industrial Minerals, 2010b).

Industry events in 2010

Interest in REE has risen considerably in 2010 as a result of security of supply issues, which are caused largely by China's dominance of the global REE industry. Governments worldwide have begun to develop policies aimed at protecting industries in their countries, particularly those requiring supplies of REE for green technologies. The growing demand from these technologies has resulted in considerable exploration in recent years. As of the beginning of November 2010, there were 251 individual rare earth projects at various stages, being run by 165 companies in 24 different countries outside China (Hatch, 2010).

The Lynas Corporation Ltd began mining and stockpiling ore from the Mount Weld bastnäsite deposit in Western Australia in 2007. Since then Lynas has experienced a number of delays to the project, but by the end of 2009 it had secured A$450 million in the equity markets and received all approvals in Australia and Malaysia to complete construction of processing plants (Curtis, 2010). The company released a new resource estimate in September 2010 upgrading the resource by 15 per cent to 1.4 million tonnes of REO. Commissioning of the concentration plant is on track for February 2011 and the Lynas Advanced Materials Plant (LAMP) in Malaysia is due for completion by September 2011. Lynas plans to be online by the third quarter of 2011; this would be the first new production outside China. The company plans to produce 11 000 tonnes of REO per year initially, to be ramped up to 22 000 tonnes by 2012 (Lynas, 2010). In December Lynas received approval from the government of Malawi to acquire the Kangankunde rare earth deposit for US$4 million. The deposit has an inferred resource of 107 000 tonnes REO at an average grade of 4.24 per cent REO (Industrial Minerals, 2010d).

Alkane Resources has been operating a demonstration pilot plant for the processing of its Dubbo Zirconia project in New South Wales since 2008 and in August 2010 announced it had started larger scale production of an yttrium heavy rare earth concentrate from the new rare earth circuit (Alkane Resources, 2010). Due to the dramatic changes in the rare earths industry the company is considering increasing its base case from 400 000 tonnes of ore throughput to one million tonnes per year which would equate to 6500 tonnes of rare earths, of which approximately 1500 tonnes would be yttrium and heavy rare earths. Depending on financing and permissions Alkane plans to be in production by 2013 (Chalmers, 2010).

Arafura Resources announced that it had raised A$90 million to fund advanced development of the Nolans Rare Earths Phosphate Project in Northern Territory and a REE processing plant in South Australia (Arafura, 2010). The project was given major project status by the South Australian government in September and the company announced that the test separation work on heavy and medium REO had been completed (Evans, 2010). Arafura plans to begin construction in 2012 and expects production in 2013 at an annual rate of 20 000 tonnes REO per year (Metal Bulletin, 2010).

Navigator Resources announced in October that it plans to undertake a distribution of shares to its shareholders in a new rare earth oxide focused company to be listed on the ASX early in 2011. The initial focus of this company will be the Cummins Range deposit in Kimberley, Western Australia, which contains an inferred resource of 4.17 million tonnes at 1.72 per cent REO (Navigator Resources, 2010).
Molycorp Minerals LLC announced in March that an exploration programme would be carried out in 2010 and 2011, for the purpose of better delineating the existence and extent of various bastnäsite, monazite and other rare earth bearing mineral deposits known to exist outside the current mining area on the company's property and claims at Mountain Pass, California, USA (Business Wire, 2010). The company is currently preparing to modernise its processing facilities and restart mining the deposit. Molycorp plans to be in full production in the second half of 2012 and expects to produce at a rate of 20 000 tonnes of REO equivalent per year and will offer a range of rare earth products, including high-purity oxides, metals, alloys, and permanent magnets (Molycorp, 2010).

Rare Element Resources released the results of an independent scoping study on its Bear Lodge rare earths project in Wyoming, USA, at the end of September. The study provided an initial development model where a conservative production rate beginning at 500 tonnes per day of mineralised material will progressively increase to 1000 tonnes per day by year three. Once full production is achieved, the total rare earth oxide (TREO) produced each year would be approximately 11 400 tonnes in bulk rare earth concentrates (Rare Element Resources, 2010).

Wings Enterprises and Glencore International have announced their intention to develop the Pea Ridge Mine in Missouri, USA, for rare earths and iron ore. The company plan to mine from enriched apatite mineralisation from the primary iron ore deposit and from breccia pipes that lie alongside the iron ore, as well as processing rare earths from the mine's tailings lake, which contains by-products from earlier mining (Mineweb, 2010).

Avalon Rare Metals released an upgraded resource estimate for their Nechalacho deposit at Thor Lake in the Northwest Territories, Canada. Recent drilling increased the indicated mineral resources in the key Basal Zone part of the deposit by 40 per cent. The total indicated mineral resources in the Basal Zone now stand at 20.45 million tonnes, grading 1.75 per cent TREO. An independent scoping study on Quest Rare Minerals' Strange Lake property in Quebec has stated that it has the potential to produce for at least 25 years. Inferred resources were estimated at 40.4 million tonnes REO with an average grade of 1.16 per cent REO (Mining Journal, 2010a). Matamec Explorations Inc announced preliminary analytical results from its drilling programme on its rare earth-yttrium-zirconium Kipawa deposit, located within the Zeus property in western Quebec, Canada. Mineralised zones were intercepted with up to 16.45 metres thick, grading 0.954 per cent TREO, 38 per cent of which is HREO+Y (Matamec Explorations, 2010).

In 2010 the Great Western Minerals Group Ltd (GWMG) launched exploration programmes at its Douglas River project in Saskatchewan and True Blue project in Yukon (joint venture with True North Gems Inc.). The company also began drilling at the Red Wine property in Labrador (a joint venture with Search Minerals Inc) and released an update on the Benjamin River exploration project in New Brunswick (all in Canada). In September the government of South Africa granted a New Order Mining Right to Steenkampskraal Monazite Mine located in the Western Cape Province of South Africa. GWMG and Rare Earth Extraction Co. Limited (Rareco) plan to bring Steenkampskraal into production as one of the first new rare earth mines outside China (GWMG, 2010).

Frontier Rare Earths Ltd released a NI 43-101 compliant mineral resource estimate for its Zandkopsdrift REE project in South Africa. Indicated resources have been estimated at 22.92 million tonnes, averaging 2.32 per cent TREO, with a further inferred mineral resource of 20.81 million tonnes at 1.99 per cent TREO (Frontier Rare Earths, 2010).

The government of Greenland amended its ban on uranium mining in September. The exploration of radioactive elements such as uranium and thorium will be permitted on a case-by-case basis. This amendment brings immediate benefits to Greenland Minerals and Energy, which owns 61 per cent of the uranium-rare earth deposit Kvanefjeld in south-west Greenland. The government has approved an updated exploration licence that will allow the company to develop a mine plan for both rare earths and uranium at the Kvanefjeld deposit (Greenland Minerals and Energy, 2010). Resources are estimated to be sufficient to support a 23-year mine life with an output of 44 000 tonnes REO per year (Mining Journal, 2010b).

Stans Energy Corp acquired a mining licence for the past-producing REE mine Kutessay II, as well as an exploration licence for the Aktyuz REE ore field in Kyrgyzstan. The company commenced a re-sampling programme at Kutessay II in 2010 in order to confirm the results of historical geological sampling and to validate historical reserve estimates, which was completed in December (Stans Energy, 2010).

Summit Atom Rare Earth Co (Sareco), a joint venture between Japanese Sumitomo Corp and Kazakhstan's state-owed nuclear company Kazatomprom, plans to extract rare earths from uranium mine tailings in Kazakhstan. A pilot plant is planned to start at the end of 2011. The company anticipates production of 15 000 tonnes of REO per year by 2015 (Suleymanov, 2010).

Tasman Metals Ltd announced in November the first NI 43-101 compliant independent resource estimate for its Norra Karr rare earth element-zirconium project in Sweden. The deposit hosts an inferred mineral resource of 60.5 million tonnes averaging 0.54 per cent TREO, 53 per cent of which are the higher value heavy REO (HREO; Tasman Metals, 2010).

AMR Resources began to stockpile material from its Aksu Diamas REE and minor metals project in south-western Turkey in 2010. The company is currently seeking partners for co-operation in the technical extraction (Industrial Minerals, 2010e).

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Production of rare earth oxides

tonnes (metric)

Country	2005	2006	2007	2008	2009
Russia	2 027	2 935	2 711	2 470	* 2 500
Brazil	620	620	760	540	650
China (a)	* 119 000	* 133 000	* 120 000	* 125 000	* 120 000
India (b)(c)	122	45	35	* 20	* 20
Malaysia	210	580	440	150	20

Note(s)

(1) All the figures in this table are either reported as rare earth oxides or are calculated to rare earth oxide equivalent
(2) Previous editions of this book included a table for production of 'rare earth minerals' rather than the current 'rare earth oxides'. Users should exercise caution when comparing statistics over longer time periods
(3) Although rare earth minerals are believed to be extracted in other countries, there is insufficient evidence to suggest that rare earth oxides are produced in those countries
(4) In addition to the countries listed, the USA are known to be producing rare earth oxides from existing stockpiles. Best available estimates suggest this is in the order of 2000 tonnes per year

(a) Includes production from iron ore extraction, bastnasite concentrates and ion absorption clays
(b) Years ending 31 March following that stated
(c) May include small quantities of other rare earth compounds

Production of salt

tonnes (metric)

Country	2005	2006	2007	2008	2009
Albania					
Sea salt	47 219	* 47 000	* 47 000	* 47 000	* 47 000
Armenia	34 682	37 000	34 800	37 334	29 402
Austria					
Rock salt	1 497	1 336	1 172	503	—
Salt in brine	771 455	764 103	735 724	866 674	1 035 044
Azerbaijan	11 202	12 000	7 126	7 527	5 466
Belarus	1 839 300	2 075 693	1 665 350	1 866 499	2 089 282
Bosnia & Herzegovina	392 940	416 305	502 487	538 357	556 089
Bulgaria	1 900 000	2 000 000	2 000 000	2 100 000	1 300 000
Croatia	36 970	29 589	32 536	54 937	57 186
Denmark	* 600 000	* 600 000	* 600 000	* 600 000	* 600 000
France					
Rock salt	494 000	...	...	...	...
Brine salt	1 468 000	...	...	...	...
Salt in brine	4 750 780	(a) 9 371 000	(a) 6 139 840	(a)* 6 000 000	(a)* 6 000 000
Sea salt	1 026 000	...	...	...	...
Germany					
Rock salt	8 258 000	9 280 000	4 826 000	5 545 438	7 709 844
Brine salt	1 006 000	1 001 000	1 010 000	989 208	1 862 630
Salt in brine	7 449 000	7 189 000	7 558 000	7 306 745	* 7 300 000
Greece	198 024	* 200 000	212 000	* 220 000	* 189 000
Italy					
Rock salt & brine salt	3 475 734	2 823 960	2 214 133	2 334 315	3 471 206
Montenegro					
Sea salt	—	5 000	20 000	25 200	17 000
Netherlands	6 155 000	6 056 000	6 177 000	6 200 000	5 967 000
Poland					
Rock salt	1 123 219	1 129 875	591 240	618 111	988 545
Brine salt	2 889 941	2 899 076	2 930 726	2 783 198	2 533 413
Other salt	118 703	808 247	785 694	706 618	484 486
Portugal					
Rock salt	597 945	586 190	590 588	606 545	576 723
Sea salt	92 495	76 858	64 048	69 249	72 325
Romania	2 442 640	2 621 129	2 475 349	2 526 774	* 2 500 000
Russia	2 700 000	2 800 000	2 200 000	1 800 000	1 600 000
Serbia	—	29 847	30 023	30 115	28 783
Slovakia	105 100	122 500	117 000	109 510	41 000
Slovenia	803	1 624	3 029	535	2 924
Spain					
Rock salt	2 909 526	2 809 046	2 709 545	2 909 907	2 254 543
Sea salt	1 368 960	1 506 343	1 332 360	1 290 672	1 207 544
Other salt	121 461	115 826	102 524	102 149	91 793
Switzerland	539 000	525 000	353 000	368 000	554 000
Turkey					
Rock salt	512	...	...	...	...
Sea salt	529 235	* 500 000	* 500 000	* 500 000	* 500 000
Other salt	1 196 486	* 1 200 000	1 385 822	1 367 981	* 1 300 000
Ukraine	4 811 000	5 996 000	5 547 852	4 425 317	5 394 512
United Kingdom					
Rock salt	* 2 000 000	* 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 (b)	* 2 800 000	* 2 800 000	* 2 800 000	* 2 800 000	* 2 800 000
Algeria					
Brine salt & sea salt	302 700	259 596	183 189	201 603	269 255
Angola	* 30 000	35 000	* 35 000	* 35 000	* 35 000
Benin (c)	* 15 000	* 15 000	* 15 000	* 15 000	* 15 000
Botswana	243 945	151 595	165 710	170 994	241 114
Burkina Faso	* 5 000	* 5 000	* 5 000	* 5 000	* 5 000
Cape Verde	* 1 600	* 1 600	* 1 600	* 1 600	* 1 600
Egypt (d)	* 1 000 000	* 1 000 000	1 213 643	1 879 351	2 951 636
Eritrea	6 300	9 737	7 448	26 071	* 26 000
Ethiopia					
Rock salt (e)	24 202	19 271	12 899	30 414	41 847
Other salt (e) (f)	...	...	...	31 971	70 541
Ghana	250 000	250 000	* 250 000	238 727	* 250 000
Guinea	* 15 000	* 15 000	* 15 000	* 15 000	* 15 000

Production of salt

tonnes (metric)

Country	2005	2006	2007	2008	2009
Kenya (f)	26 595	35 024	11 596	24 345	24 125
Libya	* 40 000	* 40 000	* 40 000	* 40 000	* 40 000
Madagascar	65 000	70 000	70 000	* 70 000	* 70 000
Mali	* 6 000	* 6 000	* 6 000	* 6 000	* 6 000
Mauritania	* 20	310	420	570	455
Mauritius (c)	7 900	7 408	6 650	5 042	2 301
Morocco	351 100	319 900	215 754	219 187	310 300
Mozambique (c)	* 80 000	* 80 000	* 80 000	* 80 000	* 80 000
Namibia	573 248	603 501	810 942	732 000	* 700 000
Niger	1 269	* 1 300	* 1 300	* 1 300	* 1 300
Senegal	134 000	198 600	212 300	240 600	222 500
Somalia	* 1 000	* 1 000	* 1 000	* 1 000	* 1 000
South Africa	399 087	464 909	407 079	415 996	408 422
Sudan	* 84 000	11 638	22 922	10 581	35 793
Tanzania	51 166	34 798	35 224	25 897	27 393
Tunisia (c)	1 132 000	1 127 000	933 000	1 063 500	1 260 100
Uganda	* 1 500	* 1 500	—	—	—
Bahamas	1 470 176	1 143 000	882 300	1 024 400	* 1 000 000
Canada					
Rock salt	11 448 141	11 504 207	* 10 175 000	* 12 090 000	* 12 381 000
Other salt (g)	2 047 653	1 901 453	* 1 796 000	* 2 134 000	* 2 185 000
Costa Rica	* 20 000	* 20 000	* 20 000	* 20 000	* 20 000
Cuba	172 592	198 200	179 500	151 900	161 500
Dominican Republic					
Sea salt	* 50 000	* 50 000	* 50 000	* 50 000	* 50 000
El Salvador (c)	* 31 000	* 31 000	* 31 000	* 31 000	* 31 000
Guatemala (c)	* 60 000	* 60 000	* 50 000	* 50 000	* 50 000
Honduras	* 42 000	* 40 000	* 40 000	* 40 000	* 40 000
Mexico	9 507 623	8 371 353	8 032 273	8 808 714	7 445 025
Netherlands Antilles	* 500 000	* 500 000	* 500 000	* 500 000	* 500 000
Nicaragua (c)	* 30 000	* 30 000	* 30 000	* 30 000	* 30 000
Panama (c)	19 429	19 080	20 315	21 053	19 548
USA					
Rock salt (h)	17 700 000	16 500 000	16 800 000	19 800 000	* 17 480 000
Salt in brine (h)	19 900 000	19 900 000	19 700 000	18 900 000	* 20 240 000
Evaporated salt (h)	7 600 000	8 090 000	7 990 000	8 580 000	* 8 280 000
Argentina	1 845 833	1 917 656	2 357 674	1 681 313	1 477 532
Brazil					
Rock salt	1 559 000	1 622 000	1 621 000	* 1 600 000	* 1 600 000
Sea salt	5 519 618	5 122 197	5 365 091	5 200 000	* 5 200 000
Chile	6 067 583	4 580 471	4 403 743	6 431 029	8 382 215
Colombia					
Rock salt	215 905	248 245	266 941	245 170	255 332
Sea salt	445 562	389 630	309 557	386 461	356 797
Ecuador	* 75 000	* 75 000	* 75 000	* 75 000	* 75 000
Peru	438 375	971 710	1 185 273	1 276 274	1 567 279
Venezuela (c)	* 350 000	* 350 000	* 350 000	* 350 000	* 350 000
Afghanistan	…	…	…	145 532	163 641
Bangladesh (d)	650 000	* 650 000	* 650 000	* 650 000	* 650 000
Burma (i)(j)	111 314	83 276	61 475	101 083	127 169
Cambodia	90 963	59 000	76 651	* 78 000	* 30 000
China	46 610 600	56 631 300	59 755 300	59 527 800	58 451 000
India					
Rock salt (j)	1 871	1 753	1 200	2 100	2 300
Sea salt (j)	14 242 700	13 268 500	12 328 000	13 970 500	17 478 600
Other salt (j)	4 724 400	4 628 100	5 516 000	5 178 600	6 470 400
Indonesia	* 680 000	* 700 000	* 700 000	* 700 000	* 700 000
Iran (k)	2 032 445	2 617 902	2 534 871	2 158 280	* 2 200 000
Iraq	* ...	* ...	153 140	108 870	113 130
Israel (c)	570 000	* 640 000	399 904	420 809	356 889
Japan (j)	1 227 000	1 166 000	1 138 000	1 132 000	1 095 000
Jordan	29 500	28 800	17 000	25 400	2 500
Kazakhstan	178 167	416 680	227 643	504 100	222 942
Korea (Rep. of)	378 887	285 568	249 515	384 304	382 270
Korea, Dem. P.R. of	* 500 000	* 500 000	* 500 000	* 500 000	* 500 000

Production of salt

tonnes (metric)

Country	2005	2006	2007	2008	2009
Kuwait	* 50 000	* 50 000	* 50 000	* 50 000	* 50 000
Laos	34 139	* 35 000	* 35 000	* 35 000	* 35 000
Lebanon	* 15 000	* 15 000	* 15 000	* 15 000	* 15 000
Mongolia	197	167	4	115	5
Oman	10 900	26 300	10 400	10 400	* 10 400
Pakistan					
Rock salt (d)	1 648 223	1 858 931	1 872 664	1 849 000	* 1 849 000
Sea salt (d)	14 375	15 249	10 616	* 11 000	* 11 000
Philippines (c)	420 950	418 210	437 689	510 059	516 066
Saudi Arabia					
Rock salt & brine salt	1 634 299	1 611 992	1 507 000	1 600 000	* 1 600 000
Sri Lanka	85 179	87 560	70 208	65 972	62 217
Syria	110 000	133 000	81 000	88 600	78 263
Taiwan	114 389	107 713	107 720	118 046	171 583
Tajikistan	65 992	51 956	47 462	47 446	50 637
Thailand					
Rock salt	1 074 214	1 008 251	1 134 931	1 211 581	* 1 200 000
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	898 000	842 000	857 000	847 000	* 850 000
Yemen, Republic of	47 000	53 000	61 000	69 000	* 80 000
Australia (l)	12 299 000	11 364 000	10 801 000	11 160 000	10 316 000
New Zealand	* 90 000	83 000	102 000	67 000	67 000
World Total	250 200 000	259 600 000	250 200 000	259 500 000	266 700 000

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

Production of selenium metal

tonnes (metric)

Country	2005	2006	2007	2008	2009
Belgium	* 200	* 200	* 200	* 200	* 200
Finland	66	70	52	65	66
Germany	* 250	* 250	* 250	* 250	* 230
Poland	82	87	85	82	80
Russia	100	110	110	* 110	* 110
Sweden	122	135	126	139	* 140
Canada	107	117	144	191	173
Peru	70	75	59	60	61
China	* 65	* 65	* 65	* 65	* 65
India (a)	8	—	—	—	—
Japan	625	730	806	754	709
Kazakhstan	* 60	* 70	155	* 130	* 120
Philippines	* 68	* 65	* 65	* 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 (metric)

Country	2005	2006	2007	2008	2009
France					
Andalusite	* 65 000	* 65 000	* 65 000	* 65 000	* 65 000
South Africa					
Andalusite	228 375	* 230 000	* 230 000	* 245 000	* 245 000
USA					
Kyanite (a)	112 000	112 000	118 000	115 000	* 80 000
Brazil					
Kyanite (b)	* 200	* 200	* 200	* 200	* 200
India					
Kyanite (c)	8 869	8 059	5 102	4 351	5 414
Sillimanite (c)	33 119	26 366	40 537	33 721	29 774
Nepal					
Kyanite (d)	27	21	18	15	10
Australia					
Sillimanite	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 believed to be produced in Brazil, Germany and Hungary
(3) Production capacity for synthetic mullite also exists in China, India, Japan, USA and United Kingdom but output is believed to be zero

(a) Including related minerals
(b) Including beneficiated and directly shipped material
(c) Years ended 31 March following that stated
(d) Years ending 15 July of that stated

Mine production of silver

kilograms (metal content)

Country	2005	2006	2007	2008	2009
Armenia	* 4 000	* 4 000	* 4 000	* 4 000	* 4 000
Bulgaria	* 55 000	* 65 000	* 55 000	* 55 000	* 55 000
Finland	47 462	50 843	44 895	69 906	69 600
Greece	2 300	25 500	38 300	35 500	30 177
Ireland, Republic of	10 500	12 900	9 650	7 172	5 267
Italy	100	—	—	—	—
Macedonia	—	* 10 000	* 30 000	* 40 000	* 35 000
Poland	1 262 400	1 265 100	1 199 500	1 161 000	1 150 000
Portugal	23 786	20 078	26 514	28 825	22 472
Romania	* 18 000	* 18 000	* 18 000	* 18 000	* 18 000
Russia (a)	* 1 350 000	* 1 250 000	* 1 200 000	* 1 300 000	* 1 400 000
Serbia (a)	—	* 2 200	* 4 200	* 4 000	* 4 000
Serbia and Montenegro (a)	* 2 600	—	—	—	—
Slovakia	65	74	50	198	201
Spain	5 227	2 369	—	—	—
Sweden	309 933	292 255	323 171	293 068	288 590
Turkey	219 000	* 266 000	* 315 000	* 286 000	* 286 000
United Kingdom	—	—	212	398	505
Algeria	800	500	500	114	200
Congo, Democratic Republic	53 600	67 600	76 200	34 100	—
Ethiopia (b)	883	902	900	2 714	771
Ghana	3 571	3 142	3 300	3 200	2 580
Morocco	185 700	202 300	177 712	201 195	210 000
Namibia (a)	34 102	31 307	7 902	7 700	700
Niger	201	* 100	139	289	* 300
South Africa	89 023	86 951	70 089	75 199	77 780
Sudan	* 2 600	2 437	2 405	—	413
Tanzania	12 891	14 906	12 381	10 388	8 231
Tunisia	* 4 000	—	—	—	—
Zimbabwe	3 400	* 1 000	* 1 100	500	—
Canada	1 123 837	995 024	860 449	755 103	630 897
Costa Rica	196	486	331	—	—
Dominican Republic	—	—	—	—	18 973
Guatemala	7 074	49 780	88 247	99 131	127 836
Honduras	53 617	55 036	53 894	58 936	57 698
Mexico	2 894 161	3 028 395	3 135 430	3 236 312	3 553 841
Nicaragua	2 936	2 929	3 420	3 720	4 491
USA	1 225 800	1 155 300	1 281 000	1 250 000	1 238 800
Argentina	263 766	245 124	255 567	355 596	415 235
Bolivia	420 300	472 210	525 000	1 114 000	1 325 730
Brazil	6 672	10 000	18 620	19 000	* 19 000
Chile	1 399 539	1 607 164	1 936 465	1 405 020	1 301 018
Colombia	7 142	8 399	9 766	9 162	10 827
Peru	3 193 146	3 470 661	3 493 090	3 685 931	3 854 019
Burma (a)(c)	* 2 300	* 700	* 200	—	—
China	2 500 000	* 2 600 000	* 2 700 000	* 2 800 000	* 2 900 000
India (c)	27 961	53 271	80 697	105 301	135 308
Indonesia	328 749	261 398	268 967	226 051	326 773
Iran	* 25 000	* 30 000	* 40 000	* 40 000	* 40 000
Japan	54 100	11 500	—	—	—
Kazakhstan (a)	883 200	806 083	722 927	645 627	618 100
Korea (Rep. of)	41 489	56 256	57 369	76 196	81 512
Korea, Dem. P.R. of	* 50 000	* 50 000	* 50 000	* 50 000	* 50 000
Laos	3 405	6 331	4 499	6 706	14 726
Malaysia	402	410	296	349	367
Mongolia	19 888	20 378	20 455	19 954	20 397
Oman	111	4 404	3 863	2 140	2 162
Philippines	19 150	23 502	27 754	14 224	33 808
Saudi Arabia	13 501	9 103	9 028	8 233	6 900
Thailand	14 013	11 240	7 727	5 465	15 300
Uzbekistan	* 60 000	* 60 000	* 60 000	* 60 000	* 60 000

Mine production of silver

kilograms (metal content)

Country	2005	2006	2007	2008	2009
Australia	2 417 000	1 727 000	1 880 000	1 926 000	1 633 000
Fiji	1 418	494	—	265	313
New Zealand	43 003	27 221	8 553	18 269	14 264
Papua New Guinea	51 125	51 098	48 677	48 062	55 082
World Total	20 855 000	20 606 000	21 273 000	21 683 000	22 236 000

Note(s)
(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 (metric)

Country	2005	2006	2007	2008	2009
Botswana	279 085	255 677	279 625	263 566	215 188
Ethiopia (a)	2 771	2 389	* 3 000	3 707	4 046
Kenya	360 161	374 210	386 578	502 846	404 904
USA	11 000 000	1 100 000	11 100 000	11 300 000	10 900 000

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

Production of strontium minerals

tonnes (metric)

Country	2005	2006	2007	2008	2009
Spain	336 630	280 195	142 512	138 590	57 466
Turkey	* 18 000	* 6 300	* 4 200	* 1 600	...
Morocco	2 700	* 2 700	* 2 700	* 2 700	* 2 700
Mexico	110 833	128 321	96 902	29 621	36 127
Argentina (a)	7 233	19 822	4 904	14 910	8 169
China	700 000	* 700 000	* 700 000	* 700 000	* 700 000
Iran	672	17 170	—	—	* —
Pakistan (b)	1 855	1 290	1 641	1 000	* 1 000

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	2005	2006	2007	2008	2009
Austria					
Recovered (a)	54 377	50 097	50 501	48 024	48 624
Belarus					
Recovered (a)	48 663	38 567	41 031	44 016	47 188
Belgium					
Recovered (b) (a)	376 000	391 000	395 000	394 000	322 000
Bulgaria					
Recovered (b)	312 000	340 000	359 000	352 000	379 000
Recovered (a)	30 000	35 000	35 000	30 000	35 000
Croatia					
Recovered (a)	9 000	7 000	9 000	7 000	11 000
Czech Republic					
Recovered (a)	65 000	65 000	65 000	61 000	55 000
Denmark					
Recovered (a)	4 223	4 142	3 896	3 467	4 200
Finland					
Pyrites	184 400	199 700	194 400	226 000	153 600
Recovered (b)	304 751	325 793	* 326 000	331 000	273 600
Recovered (a)	70 000	70 000	125 000	117 000	127 000
France					
Recovered (a)	622 345	616 234	605 820	* 590 000	* 590 000
Recovered (e)	127 000	75 000	62 000	64 000	65 000
Germany					
Recovered (a)	1 627 900	1 706 200	1 650 100	1 578 000	1 624 000
Recovered (e)	42 900	42 500	35 900	39 000	…
Greece					
Recovered (a)	162 000	162 000	165 000	120 000	142 000
Hungary					
Recovered (a)	65 000	50 000	65 000	55 000	50 000
Italy					
Recovered (b)	92 000	87 000	84 000	82 000	79 000
Recovered (a)	650 000	680 000	650 000	645 000	625 000
Lithuania					
Recovered (a)	74 276	61 135	42 618	73 870	69 722
Netherlands					
Recovered (b)	141 000	141 000	116 000	108 000	98 000
Recovered (a)	440 000	495 000	505 000	515 000	510 000
Norway					
Recovered (b)	* 110 000	* 110 000	* 95 000	* 95 000	* 90 000
Recovered (a)	19 000	20 000	18 000	28 000	25 000
Poland					
Frasch	801 799	800 200	833 583	762 119	262 769
Recovered (b)	289 000	308 000	* 304 000	* 305 000	* 300 000
Recovered (a)	186 600	203 100	211 900	215 000	79 004
Portugal					
Recovered	30 000	38 000	27 000	22 000	23 000
Romania					
Recovered	79 000	60 000	64 000	61 000	74 000
Russia					
Pyrites	304 000	198 000	210 000	161 000	71 000
Recovered (a)	6 301 000	6 346 000	6 372 000	6 513 000	5 514 000
Recovered (e)	640 000	738 000	790 000	752 000	703 000
Serbia					
Recovered (b)	—	21 000	21 000	21 000	21 000
Serbia and Montenegro					
Recovered (b)	88 000	—	—	—	—
Slovakia					
Recovered (b)	5 000	5 000	5 000	5 000	5 000
Recovered (a)	65 000	65 000	78 000	75 000	71 000
Spain					
Recovered (b)	541 000	547 000	543 000	551 000	533 000
Recovered (a)	* 115 000	* 100 000	* 100 000	* 100 000	* 100 000

Production of sulphur and pyrites

tonnes (sulphur content)

Country	2005	2006	2007	2008	2009
Sweden					
Recovered (b)	180 000	180 000	177 000	199 600	186 100
Recovered (a)	59 839	68 391	66 569	84 456	83 646
Turkey					
Pyrites	55 000	59 000	61 000	79 000	79 000
Recovered (a) (e)	76 000	73 000	73 000	73 000	73 000
Ukraine					
Sulphur ore	139 000	133 000	131 000	134 000	109 000
United Kingdom					
Recovered (a)	124 000	115 000	130 000	135 000	145 000
Algeria					
Recovered (a)	20 000	19 000	20 000	20 000	20 000
Egypt					
Recovered (a)	78 000	80 000	80 000	80 000	80 000
Libya					
Recovered (a)	* 50 000	50 000	150 000	150 000	150 000
Namibia					
Pyrites	518	—	—	—	—
South Africa					
Pyrites	133 245	68 443	70 891	61 278	60 244
Recovered	220 254	231 000	236 000	187 000	* 200 000
Recovered	422 314	343 000	335 000	323 000	* 320 000
Zambia					
Recovered (b)	52 000	75 000	98 000	131 000	196 000
Zimbabwe					
Pyrites	59 683	39 777	19 812	30 308	—
Canada					
Recovered (b)	1 057 632	1 176 429	1 167 118	1 147 732	890 170
Recovered (a)	7 914 616	7 905 870	7 621 863	7 007 706	6 577 019
Cuba					
Recovered (a)	* 5 000	* 5 000	* 5 000	* 5 000	* 5 000
Mexico					
Recovered (b)	703 000	621 000	556 000	441 000	412 000
Recovered (a)	1 016 000	1 077 000	1 027 000	1 036 000	1 112 000
Netherlands Antilles					
Recovered (a)	40 000	60 000	60 000	28 000	15 000
Trinidad & Tobago					
Recovered (a)	16 000	15 000	13 000	20 000	20 000
USA					
Recovered (b)	711 000	674 000	817 000	753 000	* 810 000
Recovered (a)	8 790 000	8 390 000	8 280 000	8 690 000	* 9 000 000
Argentina					
Recovered (b)	23 000	23 000	23 000	23 000	23 000
Brazil					
Pyrites	19 618	20 954	22 336	18 200	* 20 000
Recovered (b)	266 817	297 539	321 707	359 586	* 380 000
Recovered (a)	112 093	117 203	135 623	135 354	* 135 000
Chile					
Recovered (b)	1 788 000	1 574 000	1 533 000	1 541 000	1 601 000
Colombia					
Recovered (a)	8 047	5 860	5 085	6 277	1 959
Sulphur ore	69 082	47 438	48 999	56 892	54 367
Ecuador					
Recovered (a) (c)	3 000	3 000	5 000	5 000	5 000
Peru					
Recovered (b) (d)	211 000	204 000	333 000	467 000	449 000
Venezuela					
Recovered (a)	950 000	950 000	850 000	710 000	570 000

Production of sulphur and pyrites

tonnes (sulphur content)

Country	2005	2006	2007	2008	2009
Abu Dhabi					
Recovered (a)	2 060 000	2 045 000	2 183 000	1 900 000	1 760 000
Bahrain					
Recovered (a)	71 518	64 565	71 771	80 000	108 439
China					
Pyrites	4 714 000	4 663 000	6 082 000	6 022 000	4 946 000
Recovered	3 195 000	3 588 000	4 485 000	5 268 000	5 843 000
Sulphur ore	950 000	1 000 000	1 200 000	1 537 000	1 700 000
India					
Recovered (b)	637 000	801 000	955 000	1 103 000	1 078 000
Recovered (a) (e)	576 000	801 000	951 000	1 101 000	1 451 000
Indonesia					
Recovered (b)	212 000	168 000	212 000	199 000	186 000
Recovered (a)	105 000	105 000	105 000	110 000	110 000
Iran					
Recovered (a)	1 440 000	1 440 000	1 456 000	1 629 000	1 699 000
Iraq					
Recovered (a)	100 000	100 000	100 000	100 000	100 000
Israel					
Recovered (a)	44 000	42 000	34 000	50 000	50 000
Japan					
Recovered (b) (f)	1 583 000	1 679 000	1 747 000	1 797 000	1 675 000
Recovered (a)	1 972 000	1 950 000	1 967 000	2 034 000	1 863 000
Jordan					
Recovered (a)	342 000	357 000	334 000	* 310 000	* 310 000
Kazakhstan					
Recovered (b)	235 000	* 235 000	* 235 000	392 000	490 000
Recovered (a)	1 590 000	1 586 600	1 660 700	1 732 600	2 250 000
Korea (Rep. of)					
Recovered (b)	861 000	899 000	912 000	990 000	899 000
Recovered (a)	660 000	660 000	* 670 000	* 660 000	* 660 000
Korea, Dem. P.R. of					
Pyrites	18 000	18 000	18 000	18 000	18 000
Recovered (b)	16 000	16 000	16 000	16 000	16 000
Kuwait					
Recovered (a)	836 000	742 000	830 000	830 000	930 000
Oman					
Recovered (a)	* 30 000	* 30 000	* 30 000	* 30 000	* 30 000
Pakistan					
Recovered (g)	24 158	24 730	27 710	29 000	* 29 000
Philippines					
Recovered (b)	163 000	180 000	196 000	229 000	229 000
Recovered (a)	45 000	45 000	45 000	45 000	45 000
Qatar					
Recovered (a)	450 000	395 000	503 000	526 666	657 954
Saudi Arabia					
Recovered (a)	2 700 000	2 900 000	3 100 000	3 100 000	3 214 000
Singapore					
Recovered (a)	250 000	250 000	212 000	220 000	225 000
Syria					
Recovered (a)	36 074	43 000	40 650	40 491	40 000
Taiwan					
Recovered	267 790	245 789	249 156	211 869	252 392
Thailand					
Recovered (b)	88 000	46 000	57 000	46 000	46 000
Recovered (a)	200 000	200 000	200 000	160 000	190 000
Uzbekistan					
Recovered (b)	163 000	163 000	163 000	163 000	163 000
Recovered (a)	345 000	345 000	345 000	390 000	390 000

Production of sulphur and pyrites

tonnes (sulphur content)

Country	2005	2006	2007	2008	2009
Australia					
Recovered (b)	915 000	915 000	915 000	866 000	931 000
Recovered (a)	60 000	60 000	60 000	60 000	55 000
New Zealand					
Recovered	29 000	29 000	32 000	38 000	38 000
World Total					
Pyrites	5 500 000	5 300 000	6 700 000	6 600 000	5 300 000
Frasch	800 000	800 000	800 000	800 000	300 000
Recovered	61 000 000	61 500 000	63 200 000	64 200 000	64 200 000
Sulphur ore	1 200 000	1 200 000	1 400 000	1 700 000	1 900 000

Note(s)
(a) From petroleum refining and/or natural gas
(b) From metal sulphide processing
(c) Including frasch
(d) Sulphur; all forms
(e) Other
(f) Including S content of sulphur ore
(g) Years ended 30 June of that stated

Production of talc

tonnes (metric)

Country	2005	2006	2007	2008	2009
Austria	166 569	159 447	153 409	154 577	111 388
Finland	508 169	547 146	535 882	527 686	* 500 000
France	416 000	* 420 000	* 420 000	* 420 000	* 420 000
Greece	250	* 250	200	* 200	* 200
Italy	140 581	130 714	117 643	* 110 000	* 110 000
Macedonia	1 955	1 025	1 775	977	—
Norway	34 000	* 34 000	* 34 000	* 30 000	23 350
Portugal	5 362	5 517	12 367	11 220	11 567
Romania	6 760	2 967	1 513	1 843	* 2 000
Russia	* 150 000	* 150 000	* 150 000	* 150 000	* 150 000
Slovakia	200	—	—	—	—
Spain					
Talc	90 589	83 502	78 042	59 299	47 218
Pyrophyllite	700	—	—	—	—
Sweden	7 000	6 000	7 000	4 000	4 000
United Kingdom	6 000	4 325	2 850	2 410	2 861
Egypt	38 780	* 40 000	40 572	43 990	* 45 000
Morocco					
Talc	—	1 400	944	220	—
Pyrophyllite	33 300	12 900	26 072	25 782	33 400
South Africa					
Talc	8 469	10 966	14 281	5 145	4 718
Pyrophyllite	60 267	74 886	123 666	80 704	114 666
Sudan	...	216	2 620	4 667	1 167
Zimbabwe	18	—	—	—	—
Canada	70 000	68 000	67 000	64 000	44 000
Guatemala	16 131	526	6 456	1 030	6 355
Mexico	64 827	40 535	32 410	16 405	33 421
USA	856 000	895 000	769 000	706 000	* 527 000
Argentina					
Talc	12 603	13 773	14 956	21 222	18 267
Pyrophyllite	8 470	9 340	9 880	9 230	* 10 000
Brazil (a)	413 340	389 391	401 204	* 405 000	* 400 000

Production of talc

tonnes (metric)

Country	2005	2006	2007	2008	2009
Chile	886	704	764	961	790
Peru					
Talc	14 251	14 618	23 096	17 984	13 296
Pyrophyllite	10 100	14 500	23 086	17 984	13 296
Uruguay	1 131	1 544	848	890	* 850
Bhutan	42 791	54 208	62 015	56 077	64 948
China	2 700 000	2 500 000	* 2 000 000	* 2 200 000	2 300 000
India					
Pyrophyllite (b)	182 526	147 807	203 707	235 352	243 130
Steatite (b)	681 534	739 849	922 505	832 001	819 752
Iran (c)	70 600	69 050	90 889	89 110	* 89 000
Japan					
Talc	25 491	* 25 500	* 26 000	* 26 000	* 25 000
Pyrophyllite	351 111	* 350 000	* 345 000	* 350 000	* 340 000
Korea (Rep. of)					
Talc	83 471	64 118	9 557	6 438	5 997
Pyrophyllite	885 559	677 465	798 054	892 625	617 411
Korea, Dem. P.R. of	* 50 000	* 50 000	* 50 000	* 50 000	* 50 000
Nepal (d)	5 832	6 648	9 043	7 996	6 601
Pakistan (e)	20 564	21 065	27 400	38 000	* 38 000
Thailand					
Talc	10 270	4 373	3 508	3 264	* 3 000
Pyrophyllite	177 684	131 843	415 420	106 600	* 100 000
Vietnam					
Pyrophyllite	* 12 000	* 14 000	* 16 000	...	...
Australia (e)	150 923	* 147 000	* 121 000	* 130 000	* 92 000
World Total	8 600 000	8 100 000	8 200 000	7 900 000	7 400 000

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

Production of tantalum and niobium minerals

tonnes (metric)

Country	2005	2006	2007	2008	2009
Burundi					
Columbite-tantalite	43	16	52	121	24
Congo, Democratic Republic					
Columbite-tantalite	124	52	120	380	* 400
Ethiopia					
Tantalite (a)	93	109	117	183	206
Mozambique					
Tantalite	281	95	196	396	* 400
Nigeria					
Tantalite	* 25	* 25	* 25	* 25	* 25
Columbite	45	387	180	335	* 300
Rwanda					
Columbite-tantalite	276	996	546	921	925
Canada					
Pyrochlore	* 6 900	* 9 200	* 9 500	* 9 700	* 9 600
Tantalite	233	204	167	161	88
Brazil					
Pyrochlore	* 146 000	* 175 000	* 215 000	* 240 000	* 250 000
Columbite-tantalite	* 6 600	* 5 400	* 5 000	* 5 000	* 5 000
China					
Columbite-tantalite	* 350	* 350	* 350	* 350	* 350
Malaysia					
Struverite	552	93	52	216	176
Australia					
Tantalite	* 2 500	* 1 400	* 890	* 940	* 140
World Total concentrates	164 000	193 000	232 000	259 000	268 000
Nb content	42 300	52 600	71 200	79 300	82 400
Ta content	1 700	1 300	900	1 200	800

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 tellerium metal

tonnes (metric)

Country	2005	2006	2007	2008	2009
Canada	11	11	14	20	16
USA	50	50	* 50	* 50	* 50
Peru	33	37	35	28	7
Japan	23	24	41	* 40	* 40

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

Mine production of tin

tonnes (metal content)

Country	2005	2006	2007	2008	2009
Portugal	243	25	41	29	34
Russia (a)	2 500	2 600	2 500	1 500	1 200
Burundi	4	44	28	21	12
Congo, Democratic Republic	4 400	3 800	8 900	11 800	9 400
Niger	14	13	11	* 10	* 10
Nigeria	* 1 500	1 400	2 500	1 800	1 800
Rwanda	3 399	3 013	2 685	2 135	3 154
Uganda	—	—	24	40	—
Bolivia	18 639	17 669	15 972	17 320	19 581
Brazil	11 739	9 528	11 835	13 000	10 000
Peru (b)	42 145	38 470	39 019	39 037	37 530
Burma	700	* 900	* 500	* 500	* 600
China	121 600	126 300	145 900	121 500	* 128 000
Indonesia	78 404	80 933	66 137	53 228	46 078
Laos	* 600	* 600	* 700	551	490
Malaysia	2 857	2 398	2 263	2 605	2 412
Mongolia	24	—	14	45	8
Thailand	188	225	149	235	166
Vietnam	* 5 400	* 5 400	* 5 400	* 5 400	* 5 400
Australia	2 713	2 783	2 071	1 783	13 269
World Total	297 000	296 000	307 000	273 000	279 000

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

Smelter production of tin

tonnes (metric)

Country	2005	2006	2007	2008	2009
Belgium	7 700	8 000	8 400	9 200	8 700
Russia	3 700	3 700	3 300	1 700	1 300
Bolivia (a)	13 841	14 089	12 251	12 666	14 715
Brazil	8 986	8 780	9 987	11 000	10 000
Peru	36 733	40 495	36 004	38 865	34 388
China	121 800	132 100	148 800	139 900	134 500
Indonesia	67 600	65 357	64 127	53 471	51 418
Japan	754	854	879	956	757
Malaysia	37 782	22 850	25 563	31 691	34 445
Thailand	31 600	27 540	23 104	21 860	19 423
Vietnam	2 510	2 665	3 369	3 566	* 3 600
Australia	594	572	118	—	—
World Total	334 000	327 000	336 000	325 000	313 000

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 (metric)

Country	2005	2006	2007	2008	2009
Norway					
Ilmenite	806 800	850 000	882 000	915 000	671 000
Ukraine					
Ilmenite	* 600 000	* 600 000	* 600 000	* 600 000	* 600 000
Rutile	* 100 000	* 100 000	* 100 000	* 100 000	* 100 000
Egypt					
Ilmenite	* 120 000	* 120 000	108 000	88 000	* 68 000
Mozambique					
Ilmenite	...	...	140 515	328 875	471 524
Rutile	...	...	8 782	* 8 000	* 8 000
Sierra Leone					
Ilmenite	—	13 819	15 750	17 260	15 200
Rutile	—	73 600	82 805	78 910	63 860
South Africa					
Ilmenite (a)	* 973 100	* 1 330 500	* 1 402 500	* 1 360 000	* 1 445 000
Rutile	* 130 000	125 200	111 500	132 000	134 000
Canada					
Ilmenite (a) (b)	* 2 100 000	* 2 400 000	* 2 500 000	* 2 600 000	* 2 000 000
USA	* 500 000	* 500 000	* 400 000	* 300 000	* 300 000
Brazil					
Ilmenite	127 142	* 130 000	* 130 000	* 110 000	* 110 000
Rutile	2 782	* 3 000	3 000	* 3 000	* 3 000
China					
Ilmenite	* 1 060 000	* 1 260 000	* 1 260 000	* 1 080 000	* 900 000
India					
Ilmenite (c)	703 796	692 906	678 772	* 600 000	* 650 000
Rutile (c)	20 299	16 157	20 518	* 21 000	* 21 000
Kazakhstan	* 10 000	13 500	15 700	* 16 000	* 17 000
Korea (Rep. of)					
Ilmenite	157 433	179 982	193 953	226 069	120 236
Malaysia					
Ilmenite	38 195	45 649	59 310	36 779	15 983
Rutile	5 509	16 921	1 450	1 834	1 502
Sri Lanka					
Ilmenite	36 303	57 033	70 728	56 824	122 424
Rutile	8 162	2 280	4 607	3 405	2 276
Vietnam					
Ilmenite (d)	* 530 000	* 600 000	* 650 000	* 710 000	* 700 000
Rutile	* 500	* 500	* 500	* 500	* 500
Australia					
Ilmenite	2 034 000	2 378 000	2 339 000	2 060 000	1 449 000
Rutile	177 000	232 000	312 000	318 000	281 000
Leucoxene	62 000	135 000	164 000	126 000	165 000
World Total					
Ilmenite (wt of concs)	9 800 000	11 200 000	11 400 000	11 100 000	9 700 000
Rutile (wt of concs)	400 000	600 000	600 000	700 000	600 000
All forms (TiO_2 content)	* 5 100 000	* 5 900 000	* 6 100 000	* 5 900 000	* 5 300 000

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) It is believed that the majority of this is processed into slag. In 2009 South Africa produced an estimated 1 850 000 tonnes of slag (85% TiO_2) and Canada produced an estimated 800 000 tonnes of slag (80-95% TiO_2)
(b) Canada produces some ilmenite which is sold as such and not processed into slag, but tonnages are small
(c) Years ended 31 March following that stated
(d) BGS estimates, based on known imports into certain countries

Mine production of tungsten

tonnes (metal content)

Country	2005	2006	2007	2008	2009
Austria	1 280	1 153	1 117	1 122	887
Portugal (a)	816	780	846	892	823
Russia	* 2 900	* 2 900	* 3 200	* 3 200	* 2 400
Spain	—	—	—	194	284
Burundi	94	238	163	230	100
Congo, Democratic Republic	342	975	1 095	650	* 700
Rwanda	442	1 559	1 412	1 037	689
Uganda	36	75	86	48	* 50
Canada	484	2 561	2 700	2 795	2 501
Bolivia	508	1 094	2 501	1 448	1 290
Brazil (b)	557	533	537	408	* 400
Peru	—	50	366	456	634
Burma (c)	168	197	183	136	* 100
China	51 200	45 000	41 000	43 500	50 000
Kazakhstan	...	50	100	...	...
Korea, Dem. P.R. of	* 650	* 900	* 250	* 350	* 350
Kyrgyzstan	* 100	* 100	* 100	* 100	* 100
Mongolia	53	124	166	97	27
Thailand (a)	622	546	823	582	* 600
Uzbekistan	* 300	* 300	* 300	* 300	* 300
Australia (d)(e)	44	13	30	11	17
World Total	60 600	59 100	57 000	57 600	62 300

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

URANIUM

Characteristics

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

Uranium 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 20 181 TWh of electricity were produced around the world in 2008. Of this, 13.5 per cent was produced by nuclear power, compared to 41.0 per cent produced by coal (IEA, 2010). However, some countries are far more reliant on nuclear power to generate their electricity than this overall figure would suggest. For example, in 2008, France produced 77.1 per cent of its electricity requirements from nuclear power, compared to 13 per cent in the UK.

In December 2010, there were a total of 441 nuclear reactors generating electricity in the world, with another 63 under construction. This includes 26 in China, 10 in Russia and six each in India and South Korea. A further 143 reactors were 'on order or planned', including 37 in China, and 331 reactors were 'proposed' of which 120 were in China (World Nuclear Association, 2010a).

In addition to nuclear reactors for electricity production, there are currently around 230 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 been used to propel ships since the 1950s. They are particularly useful in submarines and ships operating in Arctic latitudes where they provide considerably more power than other fuels, and enable long periods at sea without the need to refuel.

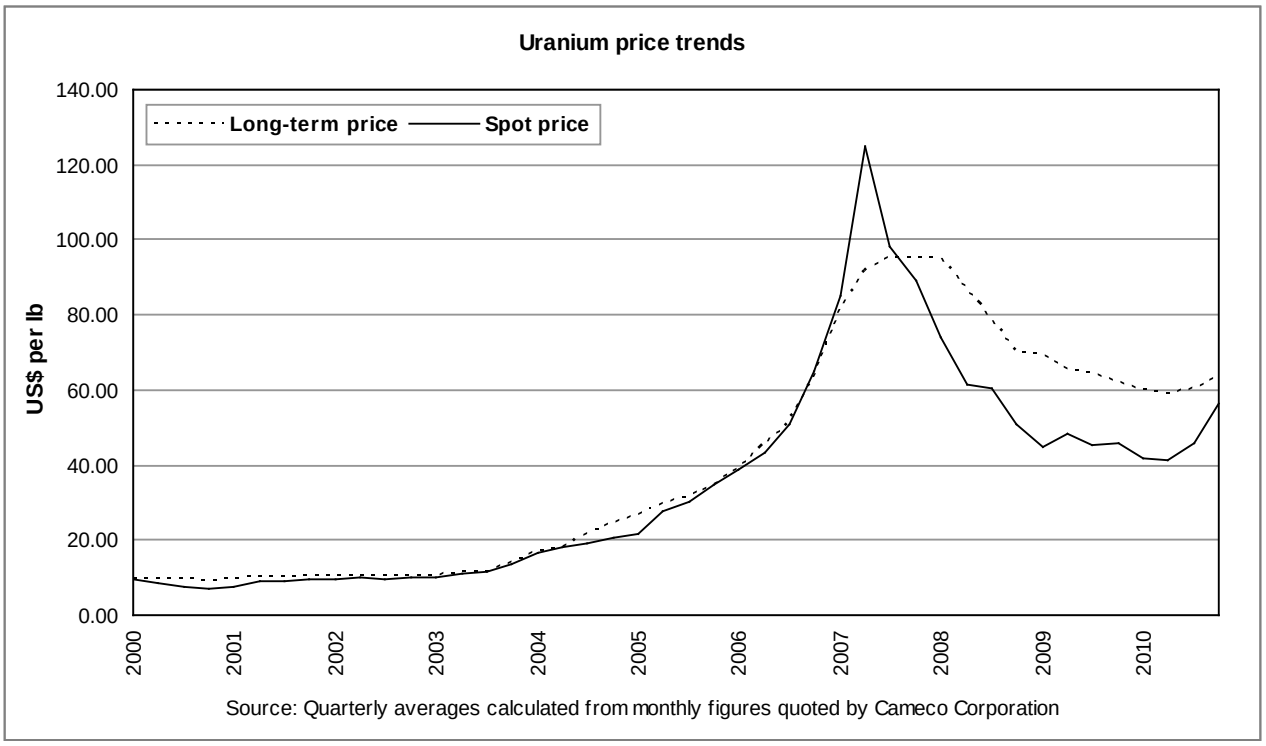
Desalination is an energy intensive process and for this purpose nuclear power is often cost-competitive with other sources of power. In several countries desalination takes place alongside electricity generation and there is potential for this combined method to increase.

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 (NPT). A large number of nations have signed the Treaty, including the five countries that 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. The work of the IAEA in attempting to enforce safeguards under the Treaty is often difficult and politically sensitive. North Korea withdrew from the Treaty in 2003 and is believed to have tested nuclear devices underground in 2006 and 2009. Negotiations have proved to be difficult and, although their nuclear facilities were closed in 2007, they subsequently expelled IAEA inspectors and have recommenced reprocessing of spent nuclear fuel (World Nuclear Association, 2010b). Another country causing concern is Iran. It is a signatory of the Treaty and insists that its construction of facilities is for peaceful purposes; however, Iran has not been entirely transparent regarding its activities, in contravention of obligations under the NPT.

World production in 2009

The total mined production of uranium (metal content) rose in 2009 for the third successive year to 50 700 tonnes; the highest annual output since 1981 and an increase of 15 per cent compared to 2008. This was due, in large part, to a 63 per cent increase in output from Kazakhstan, which has resulted in that country becoming the largest producer in the world for the first time. Over the five year period shown in this volume, Kazakhstan's production of uranium has increased by more than 200 per cent and in 2009 it amounted to 27 per cent of the world's total (up from just ten per cent in 2005).



Despite dropping to second place in the world ranking, Canada's output increased in 2009 by 13 per cent compared to 2008, thus reversing the declining trend of the last three years. However, its share of the world total has dropped from 28 per cent in 2005 to 20 per cent in 2009. Australia remained in third place, albeit with production levels declining by six per cent compared to 2008 and 16.5 per cent since 2005. Its share of the world total has fallen from 23 per cent in 2005 to 16 per cent in 2009.

Namibia produced nine per cent of the world's total in 2009 and remained in fourth place even though its output increased by a further six per cent compared to 2008. Other significant producers in 2009 were Russia (with seven per cent of the world's total), Niger (six per cent), Uzbekistan (five per cent) and the USA (three per cent). The first three of these countries increased their outputs by one per cent, eight per cent and four per cent respectively, while the USA's production dropped by five per cent, all compared to 2008.

Amongst the smaller producers it is noteworthy that Brazil's production of uranium has more than trebled over the period 2005 to 2009, although it still represents less than one per cent of the world total, and Malawi became a producer for the first time in 2009 with the opening of its Kayelekera mine.

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. However, throughout 2005 to 2007 the spot price rose sharply, reaching a high of US$138 per pound in June 2007, before falling back to just under US$46 per pound by the end of 2009. During the first half of 2010 the spot price fell further, reaching a four-year low of US$41 per pound in May. However, in the latter part of 2010 the spot price rose significantly and by December it was approximately US$61 per pound.

The long-term price also continued to fall in the first half of 2010, dropping below US$60 per pound during March to June, the lowest it has been since November 2006. However, it also rose during the second half of 2010, albeit at a slower rate than the spot price, and by December it had reached US$65 per pound.

Demand for uranium for electricity generation continues to be much higher than current mine production levels, with the shortfall being supplied by reprocessing, from stockpiles and by the conversion of weapons-grade uranium into fuel for power stations. Concerns remain over continuity of supply due to the significant increase in the number of nuclear reactors proposed or planned, partly as a result of current international efforts to reduce carbon dioxide emissions. It was reported in July 2010 that China had commenced stockpiling uranium to provide feed material for its many under-construction nuclear power stations and had at least doubled its normal purchasing requirements (Ying et al, 2010). India is also keen to supplement its domestic supply of uranium by purchases from other countries. Although Australia has decided not to supply uranium to India until it signs the NPT, there are many other countries who are willing to meet India's burgeoning demand including Kazakhstan, Canada, the USA and, notably, Russia. Discussions between Russia and India are taking place that include the possibility of India taking a stake in the development of the Elkon field in Russia's Yakutia province which is estimated to contain approximately five per cent of the world's recoverable uranium reserves (Seth, 2010).

Industry events in 2010

At the start of the year Toro Energy announced that it had received approval for a test pit to be dug at its Wiluna project in Western Australia as a part of the resource evaluation required for its bankable feasibility study. This represents another step along the way towards Western Australia becoming the third uranium-producing state in Australia (Louthean, 2010a). Several other companies have prospects in the state, including BHP Billiton at Yeelirrie which is currently in the pre-feasibility stage, and subject to obtaining

all the necessary approvals, is targeting production by 2014 (BHP Billiton, 2010).

Two studies were underway at Energy Resources of Australia's (ERA) Ranger mine in Northern Territory, the first looking at the feasibility and environmental impact of heap leaching to recover uranium from low grade material within the existing open pit and the other involving underground exploration drilling to examine the feasibility of converting the open pit to an underground mine (Louthean, 2010b). Although the former was initially expected in 2010, the official report is now due to be completed in 2011. Production at the Ranger mine has fallen in 2010 compared to 2009 as a result of sequencing issues and lower head grades. As a consequence ERA was forced to purchase uranium oxide from elsewhere to meet its supply commitments and it undertook an infill drilling programme in the lower benches of the open pit to increase confidence in the quality and volume of ore remaining. As a result of the latter, and a pit redesign to deal with a potential instability in one wall of the open pit, the remaining resource in this part of the mine was reduced by 2400 tonnes (ERA, 2010).

The likelihood of the Olympic Dam underground mine expanding into a massive open pit operation, which would be the largest open pit uranium mine in the world and the 3rd largest open pit copper mine, took a step forward in 2010 with the South Australian state government allocating over US$5 million to a task force to assist BHP Billiton in proving the viability of the project. Once producing at its increased capacity, the operation would employ double the current 4000 workforce (Louthean, 2010c).

Elsewhere in South Australia, the Honeymoon Uranium Project JV (51 per cent Uranium One, 49 per cent Mitsui & Co Ltd) commenced the commissioning operations of the Honeymoon Uranium in-situ recovery (ISR) mine and full production is expected in 2011 (Uranium One, 2010). The issuing of a mining licence at the Four Mile project was delayed, however, as a result of legal issues between the joint venture partners Alliance Craton Explorer Pty Ltd (who own 25 per cent of the project) and Quasar Resources Pty Ltd (75 per cent). Despite this, development work continued with further drilling enabling the inferred plus indicated resource estimate for the combined Four Mile East and West deposit to be increased by 16 per cent to 9.8 million tonnes at 0.33 per cent uranium oxide (Alliance, 2010). It is not clear when the legal issues will be resolved and consequently when construction of the mine may start.

Uranium One has had an eventful 2010. At the beginning of the year it had three producing ISR mines in Kazakhstan (Akdala, 70 per cent owned by Uranium One; South Inkai, 70 per cent owned; and Kartau, 50 per cent owned) with a fourth mine in the process of commissioning (Kharasan, 30 per cent owned). In January it completed the acquisition of the Christensen Ranch and Irigaray properties in the Powder River Basin, Wyoming, USA and will start commissioning a process plant in 2011. In April it completed the sale of the problematic Dominion project in South Africa. In June it was announced that Uranium One had signed a deal with the Russian organisation Atomredmetzoloto (ARMZ) in which Uranium One would gain a 50 per cent stake in the Akbastau mine and a 49.7 per cent stake in the Zarechnoye mine, both in Kazakhstan, plus US$160 million in cash, while ARMZ would increase its shareholding in Uranium One to 51 per cent. Finally, in December, it was announced that ARMZ is to acquire Mantra Resources and transfer its one asset, the near-production stage Mkuju River Project in Tanzania, to Uranium One. Once all these deals are completed and the new mines are commissioned and ramped up to capacity, Uranium One could potentially have one of the largest attributed shares of uranium production in the world (Uranium One, 2010).

CNNC, a subsidiary of the Chinese firm China National Nuclear Corporation, made an offer for Canadian-listed Khan Resources, which owned a 58 per cent stake in the Dornod deposit in Mongolia. This came on top of a much lower offer from ARMZ that Khan had already rejected (Mineweb, 2010a). However, both offers expired later in the year because the Mongolian Nuclear Energy Agency invalidated the company's mining and exploration licences. Khan appealed through the Mongolian courts, but despite various court decisions in favour of Khan, the Nuclear Energy Agency had still not re-registered Khan's licences by December 2010 (Khan, 2010).

The world's largest undeveloped uranium deposit, Cigar Lake in Saskatchewan, Canada, was finally pumped out in 2010 following severe flooding events that occurred in the developing underground mine in 2006 and 2008. The mine, which is 50 per cent owned by Cameco and 37 per cent by France's Areva, will produce 10 per cent of the world's uranium when it comes into production (Mineweb, 2010b). Restoration of underground mine systems and infrastructure has commenced in preparation for resumed construction activities. Production is expected in mid 2013 (Cameco, 2010b).

The JV Inkai (60 per cent Cameco, 40 per cent KasAtomProm) in Kazakhstan held an official ceremony in June to celebrate the opening of the main processing plant and the full-scale start up of the Inkai in-situ recovery (ISR) mine. The site is designed to produce 2000 tonnes of uranium metal per year when it ramps up to full capacity in 2011 (Cameco, 2010b).

In September, seven uranium workers were kidnapped in Niger. The Arlit region of northern Niger, where Areva has its uranium mining operations is also the region where fighting has taken place in the past with Tuareg rebels. Four French workers were kidnapped in this region in June 2008 and held for four days. Emergency talks were immediately held regarding security in this troubled region (Irish, 2010; Areva, 2010). Al Qaeda's North African wing later claimed responsibility for the kidnapping (Irish & Fuchs, 2010).

Meanwhile in Namibia, Extract Resources has continued with infill drilling at its huge Rössing South (Husab) deposit with the latest JORC-compliance estimates, including indicated resources, containing 257 million pounds of uranium oxide (241 million tonnes at 480 ppm uranium oxide) and a further 110 million pounds in the inferred category (125.5 million tonnes at 400 ppm uranium oxide). A definitive feasibility study is due to be completed shortly, following which the company intends to apply for a mining licence (Extract Resources, 2010). Production is expected in 2014/15 and is likely to last for 20 years (Williams, 2010).

In November, Uranium Energy Corp. announced that it has started production at the first ISR mine in the USA for five years at its Palangana operation in Texas. The first of three phases is now complete in the wellfield with more than 45 injection and production wells. The first loads of yellowcake for marketing were expected to follow shortly (Kosich, 2010).

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Mine production of uranium

tonnes (metal content)

Country	2005	2006	2007	2008	2009
Czech Republic	420	383	322	290	286
Germany	80	65	41	* 40	* 60
Romania	* 90	* 90	* 77	* 77	* 75
Russia	3 431	3 262	3 413	3 521	3 564
Ukraine	* 800	* 800	846	* 800	840
Malawi	—	—	—	—	104
Namibia	2 855	2 782	2 879	4 366	4 626
Niger	3 093	3 431	3 153	2 993	3 241
South Africa	674	542	525	654	629
Canada	11 627	9 862	9 475	9 001	10 176
USA	1 034	1 579	1 744	1 501	1 426
Brazil	110	190	299	330	345
China	* 750	* 750	* 712	* 769	* 750
India	* 230	* 230	* 270	* 271	* 290
Kazakhstan	4 357	5 279	6 637	8 521	13 900
Pakistan	* 45	* 45	* 45	* 45	* 50
Uzbekistan	2 629	2 270	2 320	2 338	2 429
Australia	9 516	7 606	8 603	8 471	7 942
World Total	41 700	39 200	41 400	44 000	50 700
World Total (U_3O_8 equivalent)	49 200	46 300	48 800	51 900	59 800

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

Mine production of vanadium

tonnes (metal content)

Country	2005	2006	2007	2008	2009
Russia	* 24 000	* 24 000	* 23 000	* 23 000	* 22 000
South Africa	22 604	23 800	23 486	20 295	14 353
China	* 17 000	* 17 000	* 18 000	* 18 500	* 20 800
Kazakhstan	* 1 000	* 1 000	* 1 000	* 1 000	* 1 000
World Total	65 000	66 000	65 000	63 000	58 000

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 (metric)

Country	2005	2006	2007	2008	2009
Russia	* 30 000	* 30 000	* 30 000	* 30 000	* 30 000
Egypt	* 6 700	* 6 700	5 770	7 560	* 8 000
South Africa	209 801	197 765	199 664	199 764	193 334
Uganda	2 574	3 512	3 269	—	—
Zimbabwe	24 826	13 421	17 395	16 123	3 211
USA (a)	* 100 000	* 100 000	* 100 000	* 100 000	* 110 000
Argentina	1 403	1 585	1 726	1 813	2 150
Brazil	24 191	19 279	18 952	49 000	* 30 000
China	* 100 000	* 110 000	* 110 000	* 120 000	* 130 000
India (b)	6 674	11 827	8 910	12 686	11 841
Japan	* 6 000	* 6 000	* 6 000	* 6 000	* 6 000
Australia (c)	8 769	9 392	8 900	8 319	6 548

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 (metric)

Country	2005	2006	2007	2008	2009
Finland	15 950	16 200	16 364	15 600	* 16 000
Spain	* 30 000	* 30 000	10 918	10 100	7 000
Namibia	253	55	* 55	* 55	* 55
Mexico	27 132	44 280	50 809	46 844	29 728
USA	* 120 000	* 125 000	* 125 000	* 90 000	* 65 000
China	350 000	350 000	* 350 000	* 325 000	* 300 000
India (a)	128 582	131 572	118 666	103 459	132 385

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 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. It is 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 common 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 metamorphic 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. Australia, China, Peru, USA, Kazakhstan, Mexico and India have the largest zinc reserves (USGS, 2010).

Before zinc can be recovered from an 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 (International Zinc Association, 2010).

Total world reserves of zinc are 200 million tonnes of which China holds 33 million tonnes, Australia 21 million tonnes and Peru 19 million tonnes (USGS, 2010). 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, 2010).

Uses

Current global uses of refined zinc are (International Lead Zinc Study Group (ILZSG), 2010):

- galvanizing (50 per cent)
- brass and bronze (17 per cent)
- zinc alloys (for die-casting industry etc.) (17 per cent)
- chemicals (six per cent)
- semi-manufactures (six per cent)
- miscellaneous (four 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 (seven 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 is used as metal. The remainder is used in zinc compounds mainly by the rubber, chemical, paint, and agricultural industries (International Zinc Association, 2010).

World production in 2009

World mine production of zinc was 11.4 million tonnes (metal content) in 2009, a three per cent decrease on 2008. More than 40 countries mine zinc and the top three of these produce more than one million tonnes each (China, Peru and Australia). China was the top mine-producer of zinc and in 2009 mined just over three million tonnes, equivalent to 27 per cent of world mine production, but a three per cent decrease on 2008 figures. Peru produced 1.5 million tonnes in 2009 (13 per cent of the world's total), a decrease of six per cent compared to 2008. This is in contrast to the production increases of previous years that amounted to 33 per cent between 2005 and 2008. Australia's output fell by 15 per cent in 2009 compared to 2008, reversing production increases of the previous years, but it still contributed 11 per cent to the world's total.

World slab zinc production in 2009 was 11.4 million tonnes. This was a two per cent decrease on 2008 and reversed a similar sized increase the previous year. Production has increased fairly steadily during the period 2005 to 2008, showing an overall increase of 15 per cent. China remained the top-producing country with over four million tonnes in 2009, equivalent to 38 per cent of world zinc slab production. This represents an 11 per cent increase on 2008 and a 57 per cent increase between 2005 and 2009. Canada was the second-largest producer with 0.69 million tonnes (or six per cent of the world's total) and India third, with production of 0.66 million tonnes in 2009 (or 5.8 per cent of the world's total). India's production has more than doubled between 2005 and 2009.

Prices

Zinc prices climbed steadily in 2009 from lows of below US$1100 per tonne to a peak of just over US$2500 per tonne by the end of 2009. Zinc prices during 2010 have been more erratic. After peaking in January at US$2645 per tonne, prices dropped in two stages to just over US$1623 per tonne by the middle of the year. Prices climbed again to around US$2500 per tonne in November, before dropping and rising again. The price ended 2010 at US$2433 per tonne, more than double the price at the beginning of 2009.
Zinc prices have been largely driven by the global economic crisis and associated decreases in demand. Issues triggering concerns over market recovery included a surplus of zinc on the Chinese market, poorly constrained inventories and the uncontrolled release of large amounts of Chinese zinc onto the global market. Prices were boosted by increasing demand for zinc in China and European countries including Belgium, Germany and Spain during 2010. Increasing production, long-term warehousing deals and increasing freight costs have also contributed to rising zinc prices in 2010 (White, 2010).

Zinc cash LME daily official price
Source: Metal Bulletin, 2010a.

Industry events in 2010

The marked improvement in global financial markets during 2010 has seen the global zinc sector consolidated by several large merger and takeover deals including Vedanta Resources' US$1.34 billion cash purchase of Anglo American's zinc assets in March 2010 (O'Donovan, 2010a). Vedanta beat five other companies to the acquisition, which it completed through group company Hindustan Zinc Ltd. The total price paid included: US$698 million for Skorpion mine in Namibia, US$308 million for Lisheen in Ireland and US$332 million for a 74 per cent stake in South Africa's Black Mountain Mining (Tredway, 2010).

CBH Resources Ltd signed a US$61.2 million joint-venture deal with Japanese firm Toho Zinc Co Ltd during the early part of 2010. As part of the deal CBH Resources sold a 50 per cent stake in its Rasp zinc project at Broken Hill, New South Wales, Australia, and established a joint-venture for ownership and development. Toho is set to purchase all zinc and lead concentrates produced by Rasp for the life of the mine as well as purchasing all zinc concentrates from CBH's nearby Endeavour mine (Mining Journal, 2010a).

Other merger and takeover deals during 2010 include the US$80 million joint-venture between Glencore International and Blackthorn Resources to develop the Perkoa zinc project in Burkina Faso, comprising 6.72 million tons of resource at a grade of 16.4 per cent zinc. The project was placed on care and maintenance during 2008 as a result of the global economic crisis (Swanepoel, 2010). Likewise Chinese metal trader, Minmetals, exploited the global breakdown in financial markets during 2009 to make significant domestic and overseas acquisitions including mines owned by Hunan Nonferrous (China) and OZ Minerals (Australia). The company is now one of only four major zinc producers in China, operating predominantly in central and southern areas of the country (Metal Bulletin, 2010b).

The increased buoyancy of the global financial market encouraged Xstrata plc to partially re-open its Handlebar Hill lead-zinc mine, part of its Mount Isa operation in Queensland. The mine had been placed on care and maintenance in 2009 in response to the downturn in global commodity markets (Mining Journal, 2010b). Xstrata has also published its plans to increase production at its Mount Isa operation by 10 per cent over the next two years (Bloomberg, 2010).

The world's largest zinc smelter company, Nyrstar, entered a long-term offtake agreement with Talvivaara Sotkamo, a subsidiary of Talvivaara Mining, for 1.25 million tonnes of zinc in concentrate for US$335 million. Talvivaara will send 100 per cent of its 90 000 tonnes per annum production to Nyrstar until the 1.25 million tonnes has been delivered; the agreement is expected to reach completion in around 10 to 15 years (O'Donovan, 2010b).

During the latter stages of 2010 the Bolivian Government agreed to the construction of two zinc smelters, worth around US$500 million, in the highland regions of Oruro and Potosi, in an attempt to boost mining exports. It is estimated that these projects will take around three years to complete and will increase mining exports to US$5 billion within five years (Popper, 2010).

After an explosion at its Monaca zinc refinery in Pennsylvania, in July 2010, Horsehead Holding declared force majeure on both its special special high-grade (SSHG) zinc and zinc oxide contracts. Following the incident Horsehead was forced to buy replacement material from its competitors to fulfil customer contracts, potentially jeopardising their share of the North American market (Metal bulletin, 2010c).

Disruptions to Chinese zinc production occurred on several occasions during the course of 2010. In January, freak snow storms in central and western Inner Mongolia forced suspension of mining operations. Inner Mongolia produces around 20 per cent of total Chinese zinc output; however, the closures only had a minimal impact on the market as other operations remained stable (Metal Bulletin, 2010d). Both the Yunnan and Gansu provinces are large zinc producing regions in China. During August 2010 both provinces were affected by

large-scale mudslides, temporarily disrupting zinc production and sparking fears that zinc supplies would tighten (Metal Bulletin, 2010e). Zinc production was also disrupted in October 2010 when China's third largest zinc producer, Zhongjin Lingnan Nonfermet Co, was forced to cease production from its Shaoguan Smelter after the toxic element thallium was found in local rivers (Metal Bulletin, 2010f).

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Mine production of zinc

tonnes (metal content)

Country	2005	2006	2007	2008	2009
Armenia	3 196	2 270	2 560	3 880	3 564
Bosnia & Herzegovina	2 500	902	4 799	8 595	6 228
Bulgaria (a)	20 875	16 108	14 453	12 819	9 339
Finland	40 500	35 700	38 900	27 800	30 233
Greece	4 000	16 000	20 700	24 200	17 800
Ireland, Republic of	445 400	425 800	400 900	398 200	385 700
Kosovo	—	—	—	(c) 4 902	(c) 3 691
Macedonia	—	10 836	30 957	38 737	38 648
Poland	135 600	126 600	129 600	132 400	115 500
Portugal	—	7 505	24 380	37 900	501
Romania	13 784	8 052	849	14	—
Russia	186 000	178 000	177 000	204 000	225 000
Serbia	—	3 200	3 500	* 1 000	* 1 000
Serbia and Montenegro	1 400	—	—	—	—
Spain	—	—	—	—	1 200
Sweden	215 691	210 029	214 576	187 987	192 502
Turkey	56 000	59 000	71 000	74 000	79 000
Algeria	2 206	303	—	—	—
Congo, Democratic Republic	7 600	16 800	18 500	18 000	16 000
Morocco	77 300	74 400	54 353	80 747	41 270
Namibia	202 168	185 355	196 000	204 000	244 400
South Africa	32 112	34 444	31 062	29 002	28 200
Tunisia	15 713	—	—	—	—
Canada	666 664	637 956	630 485	750 502	698 901
Honduras	42 698	37 646	29 211	28 462	36 370
Mexico	476 307	479 400	452 012	453 588	489 766
USA	747 900	727 100	803 300	778 100	735 700
Argentina	30 227	29 808	27 025	30 349	31 869
Bolivia	159 502	172 747	214 053	383 618	430 879
Brazil	170 659	185 211	193 899	173 933	* 174 000
Chile	28 841	36 238	36 453	40 519	27 801
Peru	1 201 671	1 203 364	1 444 354	1 602 597	1 509 129
Burma	* 12 000	* 8 000	* 10 000	* 7 000	* 6 000
China	2 547 800	2 844 200	3 047 700	3 186 000	3 091 600
India (b)	472 241	504 863	551 164	652 136	677 069
Iran	156 000	166 000	75 000	86 000	115 000
Japan	41 500	7 200	—	—	—
Kazakhstan	364 300	404 600	386 000	387 400	418 600
Korea (Rep. of)	77	16	2 034	1 836	2 221
Korea, Dem. P.R. of	* 65 000	* 75 000	* 78 000	* 48 000	* 32 000
Laos	1 500	4 000	3 000	2 200	* 3 000
Mongolia	11 400	54 950	77 350	71 800	70 750
Philippines	2 000	3 000	7 400	1 619	10 035
Saudi Arabia	1 000	983	716	3 663	7 000
Thailand	30 572	32 103	26 406	17 811	27 676
Vietnam	48 000	45 000	45 000	45 000	45 000
Australia	1 367 000	1 362 000	1 514 000	1 519 000	1 290 000
World Total	10 100 000	10 400 000	11 100 000	11 800 000	11 400 000

Note(s)
(a) Metal content of ore
(b) Years ended 31 March following that stated

Production of slab zinc

tonnes (metric)

Country	2005	2006	2007	2008	2009
Belgium	222 000	238 000	254 000	251 000	137 000
Bulgaria	92 500	85 900	98 100	101 700	92 700
Finland	281 904	282 238	305 543	297 722	295 049
France	209 000	120 000	129 000	118 000	161 000
Germany	334 900	342 566	294 735	292 284	* 153 000
Italy	121 200	109 200	102 100	107 100	103 400
Kosovo	—	—	—	—	5 487
Netherlands	227 500	238 274	234 000	250 000	224 000
Norway	151 285	160 670	157 027	145 469	138 973
Poland	137 300	133 900	141 900	142 500	139 100
Romania	56 795	43 705	58 342	61 978	1 000
Russia	211 000	248 000	263 000	263 000	202 000
Serbia	—	15 000	2 000	—	—
Serbia and Montenegro	18 000	—	—	—	—
Spain	501 400	507 300	509 000	466 000	515 000
Algeria	36 699	32 854	27 249	30 752	29 000
Namibia	132 818	129 897	150 100	145 400	150 400
South Africa	104 000	90 000	101 000	82 000	86 000
Zambia	—	—	1 000	2 000	—
Canada	724 035	824 465	802 103	764 310	685 504
Mexico	327 205	279 734	321 932	305 188	313 044
USA	309 000	268 900	278 000	286 000	203 500
Argentina	40 457	45 991	46 300	42 600	35 600
Brazil	274 000	279 000	265 126	248 874	242 000
Peru	163 603	175 250	162 575	190 324	149 494
China	2 776 100	3 162 700	3 742 600	3 913 100	4 356 700
India	302 000	415 000	459 000	606 000	658 000
Iran (a)	140 000	139 000	125 000	* 110 000	115 200
Japan	638 352	614 331	597 650	615 533	540 604
Kazakhstan	338 000	364 821	358 226	365 572	327 900
Korea (Rep. of)	646 817	667 000	691 000	739 000	623 000
Korea, Dem. P.R. of	* 57 000	* 51 000	* 36 000	* 41 000	* 25 000
Thailand	104 500	94 779	99 337	107 753	104 695
Uzbekistan	42 000	46 000	71 800	70 400	* 30 000
Vietnam	* 7 000	* 10 000	* 10 000	* 16 000	* 20 000
Australia	457 000	464 000	502 000	500 000	525 000
World Total	10 200 000	10 700 000	11 400 000	11 700 000	11 400 000

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

Production of zirconium minerals

tonnes (metric)

Country	2005	2006	2007	2008	2009
Russia (a)	* 6 700	* 7 500	7 136	* 7 000	* 7 000
Ukraine	* 35 000	* 35 000	* 35 000	* 35 000	* 35 000
Gambia	—	410	355	—	—
Mozambique	...	...	26 347	* 29 000	* 29 000
South Africa	314 000	414 400	388 800	404 000	392 000
USA	164 000	143 000	121 000	122 000	* 100 000
Brazil (a)	25 657	25 120	26 739	25 300	* 25 000
China	* 120 000	* 135 000	* 140 000	* 140 000	* 140 000
India	27 133	20 535	35 976	* 36 000	* 36 000
Indonesia	* 2 600	* 65 000	* 111 000	* 65 000	* 63 000
Malaysia	4 954	1 690	7 393	984	1 145
Sri Lanka	23 587	8 321	381	1 447	10 267
Thailand	—	—	1 023	—	* —
Vietnam (b)	* 35 000	* 27 000	* 22 000	* 24 000	* 8 000
Australia	426 000	491 000	600 000	528 000	474 000
World Total	1 185 000	1 374 000	1 523 000	1 418 000	1 320 000

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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