

Transport of Australia's Minerals

Information Paper

In mid-1986 the Federal Bureau of Transport Economics engaged consultant Travers Morgan Pty Ltd to undertake a review of minerals transport in Australia. The objectives of the review were to describe the nature of mineral freight movements in Australia; to identify and assess relevant sources of data; to provide data on mineral movements by mode, origin and destination for the years 1980-81 to 1984-85; and to identify and critically assess possible methodologies for updating mineral freight movements at a later date.

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Information Paper 20

**Transport of
Australia's Minerals**

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CORRIGENDA

BTE Information Paper 20

TRANSPORT OF AUSTRALIA'S MINERALS

- p. 52 - 5th paragraph, 4th line;
'until 1983-84' should read 'for each year under review'
- p. 64 - Footnote should read;
a. Includes movements from Christmas Island to Australia.
- p. 65 - Footnote should read;
a. Excludes movements from Christmas Island to Australia.
- p. 109 - Some 533 000 tonnes of the 1984-85 movements from Christmas Island to Overseas should be to Australian ports.
- Note - The categorisation of Christmas Island as 'overseas' reflects treatment in the 1984-85 Port Authority Cargo Movements. The Christmas Island to Australia phosphate trade is more correctly classed as coastal shipping.

FOREWORD

As part of its continuing program of research into Australia's transport system, the Federal Bureau of Transport Economics undertakes the collection, analysis and dissemination of information relating to transport activities.

Although the transport of minerals in Australia represents a large proportion of the total transport task, comprehensive information on minerals transport has not been available to date. In order to fill this gap the Bureau commissioned Travers Morgan Pty Ltd to undertake a review of minerals transport. This Information Paper presents the results of that review which was undertaken in mid-1986.

The basic data for the study were obtained from a variety of published sources. Personal contact by the consultant was also made with many of the source organisations for the published data and with mineral producers. The co-operation and assistance of all individuals and organisations involved in the study is gratefully acknowledged.

The study was conducted under the direction of Mr L. Kempen in the Bureau's Systems and Information Branch. Preparation of this Information Paper from the consultant's report was undertaken by Mr N. Wuest.

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Assistant Director
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Federal Bureau of Transport Economics
Canberra
March 1987

SPECIAL NOTE

Data for this review were obtained from a wide range of sources, which raised some difficulty in terms of accuracy and consistency. In some cases, where adequate data were not available, estimates were used. Efforts were made to ensure that all significant movements of the minerals reviewed were included; that is, any movements totalling 10 000 or more tonnes in a year regardless of distance plus any other movements greater than 50 kilometres, although this was constrained to some extent by data availability. Written advice of any significant omissions or errors would be gratefully received at the address below.

The individual data on movements which are listed in Appendix I have been entered into a data base designed to operate on a micro-computer. Individuals or organisations wishing access to the data base should write to:

Assistant Director
Systems and Information Branch
Federal Bureau of Transport Economics
GPO Box 501
CANBERRA ACT 2601

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SUMMARY

The transport of minerals in Australia is undertaken largely by specialised transport networks. With the major exception of coal transport in New South Wales, minerals transport has little operational impact on the public transport system for the carriage of general and other bulk freight in Australia.

The rail and sea modes account for the bulk of the minerals transport task with rail carrying 75 per cent of total 'domestic' tonnage in 1984-85. The term 'domestic' refers to mineral movements within Australia (including coastal movements originating and terminating in Australia but excluding movements by overseas ships). Of the rail total, iron ore contributed approximately 44 per cent, most of which was transported by non-government railways. A further 42 per cent of the rail tonnage comprised coal shipments which, particularly in Queensland, are generally carried over lines constructed specifically for the transport of coal.

Less than 5 per cent of total tonnes transported in 1984-85 (8 per cent of domestic tonnage) were interstate movements. Almost all interstate transport of minerals was by coastal ship.

Significant features of the mineral transport task in Australia in 1984-85 include:

- . The total task was in excess of 475 million tonnes and 137 000 million tonne-kilometres.
- . In terms of tonnes carried, overseas ship (44 per cent) and rail (42 per cent) are the most prominent modes of transport. Pipeline and coastal ship each account for a further 6 per cent of tonnes carried while road transport accounts for approximately 2 per cent.¹

1. Many short-haul road movements were excluded from the review either because of insufficient data or because the distance was considered insignificant.

- . In terms of tonne-kilometres, coastal ship (57 per cent) and rail (36 per cent) are the dominant modes of transport within Australia. Pipeline accounts for 7 per cent of tonne-kilometres and road only 0.3 per cent.
- . Iron ore and black coal are the major minerals carried in Australia and to overseas destinations. They dominate the rail and overseas ship transport tasks, representing 86 per cent and 82 per cent respectively of tonnes carried by those modes.
- . Oil, bauxite and alumina and iron ore comprise the major tonnages carried by coastal ship. Together, these minerals represent 82 per cent of tonnes carried and 90 per cent of tonne-kilometres attributable to coastal shipping.
- . Only three of the minerals included in the review are transported by pipeline in Australia: crude oil, iron ore and limestone. Crude oil accounted for 87 per cent of tonnes carried by pipeline and 98 per cent of the tonne-kilometres.
- . The most significant interstate movements of minerals were iron ore (from Western Australia), crude oil (Victoria), bauxite and alumina (Queensland) and dolomite (South Australia). Approximately 4.6 million tonnes of crude oil were imported into Australia in 1984-85.
- . Western Australia (41 per cent of total tonnes carried), Queensland (25 per cent) and New South Wales (20 per cent) generate the bulk of the mineral flows within Australia. Iron ore makes the greatest contribution in Western Australia, although bauxite and alumina movements are also significant. In Queensland black coal accounts for 77 per cent of the total tonnes carried. Black coal was also the largest contributor in New South Wales (44 per cent of tonnes carried).
- . The remaining mineral movements are generated by Victoria (8 per cent of tonnes carried), South Australia (3 per cent) and Tasmania and the Northern Territory (both just over 1 per cent).

CHAPTER 1 INTRODUCTION

In mid-1986 the Federal Bureau of Transport Economics (BTE) engaged consultant Travers Morgan Pty Ltd to undertake a review of minerals transport in Australia. The objectives of the review were to:

- . describe the nature of mineral freight movements in Australia;
- . identify and assess relevant sources of data;
- . provide data on mineral movements by mode, origin and destination for the years 1980-81 to 1984-85; and
- . identify and critically assess possible methodologies for updating mineral freight movements at a later date.

The results of the review are detailed in BTE (1986c). This Information Paper is a compendium of the information compiled by the consultant and provides a detailed picture of the minerals transport task in Australia.

Minerals were included in the review largely on the basis of quantities produced. Although only a relatively small amount of uranium is produced in Australia it was included due to the specialised transport requirements. Refined minerals and mineral products were defined to be out-of-scope for the review. Construction materials were excluded due to difficulties in identifying production sites within the time and resources available for the review. Very little information is available on the production of construction materials by mine site and no information is available on destinations, although they are mainly produced close to sites where they are used.

The minerals covered were:

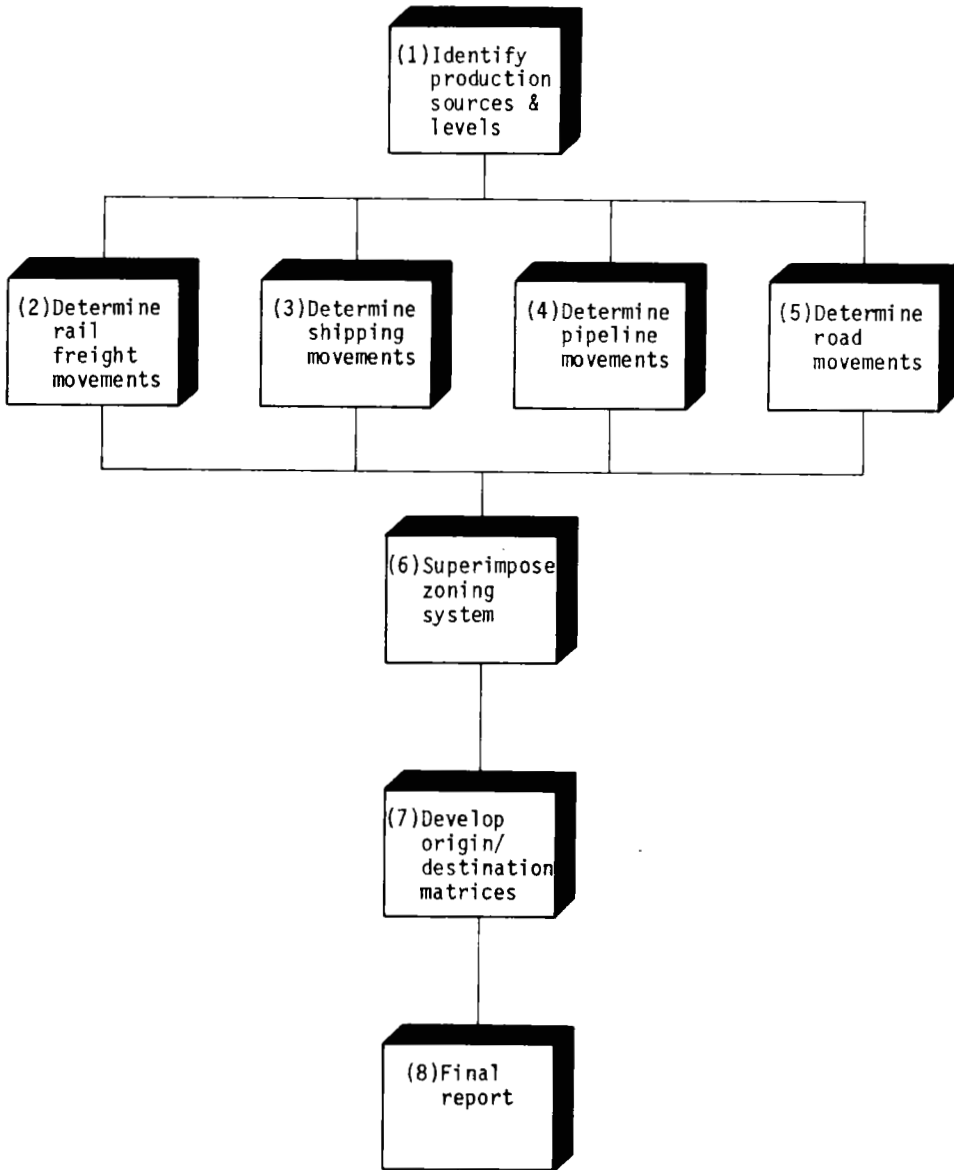
- . fuels
 - crude oil
 - black coal
 - brown coal

- . metals
 - iron ore
 - bauxite and alumina
 - nickel
 - mineral sands
 - manganese
 - lead, zinc, silver
 - copper
 - uranium
- . non-metallic minerals
 - limestone
 - clay
 - salt
 - silica
 - gypsum
 - phosphate rock
 - talc.

METHODOLOGY

The methodology adopted for the review is shown in Figure 1.1. Production sites of minerals and quantities produced were identified by reference to various data sources as described in Chapter 2. The government railways provided data on mineral movements by rail. Data on movements by non-government railways are provided to the BTE on a confidential basis for use in its Australian *Non-Government Railways* (BTE 1986a) and *Transport Indicators* (BTE 1986b) publications. Where individual movements are shown, permission was obtained from the companies concerned. Sea movements were obtained from the Port Authority Cargo Movements (PACM) publications (DoT 1985). Pipeline movements were estimated based on production figures as there is no published information on flows by pipeline.

It was originally intended that road movements would be deduced after allowing for changes in stockpiles. However, information on stockpiles is regarded as commercially sensitive by mining companies and is generally unobtainable. Information on road movements was therefore obtained from a variety of sources including mining companies. In the absence of road transport data it was generally



Source BTE (1986c).

Figure 1.1 Study approach

assumed that tonnes produced in any one year were equal to the tonnes transported. Movements are reported as tonnes and tonne-kilometres for all modes except overseas ship for which tonnes only are available.

Local government areas were generally used for origin and destination zones. These can be aggregated to Australian Bureau of Statistics (ABS) statistical divisions if required. In the large metropolitan areas statistical divisions were used for zoning. In general, intrazonal mineral movements were excluded from the review as the short distances and tonnages involved did not represent a significant transport task. There were some exceptions due to greater tonnages involved and/or the length of the movement. (See Appendix I Table I.1 for a list of the intrazonal movements included). Movements to overseas destinations were recorded simply as overseas movements. The port authority cargo statistics which were the source for information on overseas movements do not record overseas destinations.

The decision on whether to include specific movements was based on the tonnes involved, the length of the haul and the availability of data. Where data were available all movements over 10 000 tonnes per year were included; movements of less than 10 000 tonnes per year were included if the length of haul was greater than 50 kilometres.

A database was developed to contain all the information collected. For each mineral each significant movement was recorded and allocated a movement number. When minerals were moved by more than one mode to a final destination individual movements (and linkages) were identified. In order to calculate tonne-kilometres involved in the various movements, distances between origin and destination zones were obtained and entered into the database. Land distances were generally estimated from road maps. Crude oil pipeline distances were obtained from the Bureau of Mineral Resources, Geology and Geophysics (BMR). Sea distances were obtained from a matrix of port to port distances supplied by the Federal Department of Transport (DoT).

STRUCTURE OF THE PAPER

One of the objectives of this review was to identify and assess relevant sources of data. Chapter 2 describes all published sources examined by the consultant, although not all of these sources provided suitable data for the review. Those which were used in developing the minerals movement database are sourced in each table in subsequent chapters.

Chapter 3 provides an overview of each mineral included in the review, identifying major production sites and transport patterns. A brief description of end uses and final destinations for the minerals is included where possible.

Chapter 4 provides a summary of mineral flows within Australia. Mineral movements are expressed in tonnes and tonne-kilometres for each mode except overseas ship movements which are in tonnes only. A summary of mineral movements by State is also provided.

Detailed mineral movements by zone of origin and destination and by mode for the years 1980-81 to 1984-85 are presented in Appendix I. Linkages between movements are identified where applicable. Appendix II shows the modal split for mineral movements in tonnes and tonne-kilometres for each year of the review period.

CHAPTER 2 DATA SOURCES

A number of published sources of data were examined by the consultant in undertaking this review. This chapter presents a brief description of the information available from each source. The data sources described are:

- . Register of Australian Mining
- . Australian Mineral Industry Annual Review
- . ABS Mineral Production Statistics
- . ABS Shipping and Air Cargo Commodity Statistics
- . Port Authority Cargo Movements
- . State Mines Departments' Production Statistics
- . NATMAP
- . Coal Board Reports.

REGISTER OF AUSTRALIAN MINING

The Register of Australian Mining (Resource Information Unit 1986) is produced annually and covers a wide range of minerals in Australia. The minerals covered vary each year; in 1985-86 the following minerals were reviewed:

- . oil and gas
- . oil shale
- . coal
- . phosphate
- . tungsten
- . mineral sands
- . vanadium
- . molybdenum
- . cobalt

- . manganese
- . iron ore
- . bauxite and alumina
- . copper
- . lead-zinc-silver
- . uranium
- . gold
- . nickel
- . platinum
- . diamonds
- . tin
- . tantalite
- . other (salt, antimony, talc, asbestos, garnets, magnesite, lithium, bismuth, rare earths, chromium and potash).

The Register provides an overall review of the mineral industry in Australia including production, prices, exports and potential reserves in exploration areas. For each mineral covered, current and prospective mine sites are described in terms of location, owners, administration, geology, reserves and production. A list of organisations, institutions and companies involved in mining in Australia is included.

The Register was used in this study to assist in identification of mine sites.

AUSTRALIAN MINERAL INDUSTRY ANNUAL REVIEW

The Australian Mineral Industry Annual Review is prepared by the BMR (Department of Resources and Energy 1987). The Review includes most minerals produced in Australia, and in that sense is more comprehensive than the Register of Australian Mining. It also contains production data by State, and some information on production at individual sites. The statistics presented in the Review are drawn from ABS data and State Mines Departments. Until recently production statistics have generally been reported on a calendar year basis reflecting collection procedures in the States, but most States now publish financial year data.

For major minerals, the Review includes a flow diagram tracing the production, processing and end-uses of the minerals. This was

particularly useful in developing the descriptions of mineral movements. Once the major mineral flows had been identified from the various data sources described in this chapter, they were checked by discussion with officers of the BMR.

ABS MINERAL PRODUCTION STATISTICS

Each year the ABS publishes statistics on the quantity and value of minerals produced in each State (ABS 1986b). The statistics are compiled from data collected by the State Mines Departments, ABS and the Department of Resources and Energy. In the publication the minerals are classified into five major groups: metallic minerals, coal, oil and gas, construction materials, and other non-metallic minerals. The ABS considers that the coverage for the first three groups is largely complete but there are deficiencies in the coverage of construction materials and other non-metallic minerals. State and Australia-wide data only are published, due to the confidentiality requirements of the ABS (for example, there may be only one producer of a particular mineral) although individual producer data are often published by State Mines Departments.

The ABS also produces the Australian Mineral Industry Quarterly (ABS 1986a) in conjunction with the BMR. This publication contains statistics on production, exports and imports for selected minerals. The statistics include quarterly and calendar year quantity and value data.

ABS SHIPPING AND AIR CARGO COMMODITY STATISTICS

Shipping and Air Cargo Commodity Statistics (SACCS) are produced by the ABS on a quarterly basis (ABS 1986c). They are compiled from import and export documents held by the Australian Customs Service. The Australian Transport Freight Commodity Classification (ATFCC) is used to classify the commodities reported (ABS 1985). At the most disaggregated level, origins and destinations are ports of loading and discharge; also available is the State of origin which may be different from the State in which the port of loading (for exports) is situated. The statistics also include a detailed breakdown of the ship types in which sea cargo is carried. For each commodity type gross weight (that is, including any packaging) and value are recorded.

The SACCS system was specifically developed to meet the need for commodity oriented shipping and air transport statistics. The commodity classification used is the same as that for the Port Authority Cargo Movements (described in the next section).

The statistics are published on a quarterly and financial year basis. Tables contained in the publication are at a fairly aggregated level but more disaggregated data are available from the ABS on microfiche or magnetic tape.

PORT AUTHORITY CARGO MOVEMENTS

The Port Authority Cargo Movements (DoT 1985) are compiled by the Federal Department of Transport from returns supplied by port authorities. They are published annually on a financial year basis and detail ports of loading and discharge for domestic movements of cargo (in tonnes). For exports and imports specific destination and origin ports (or countries) are not published.

STATE MINES DEPARTMENTS

The Mines Departments (or equivalent) in each State publish mineral statistics in their annual reports. These statistics form the basis of data contained in ABS mineral production statistics and the Australian Mineral Industry Annual Review (Department of Resources and Energy 1987). The type and range of data published by each State varies.

In New South Wales the Department of Mineral Resources publishes State-wide mineral production figures on a financial year basis (Department of Mineral Resources, NSW 1985). The department provided unpublished statistics by mine site from 1980-81 to 1984-85 (Department of Mineral Resources, NSW n.d.) for use in this review.

In Victoria the Department of Industry, Technology and Resources is responsible for mineral matters. The Office of Minerals and Energy publishes details of quantity and value of mineral production by locality and company in its annual report (Office of Minerals and Energy, Victoria 1985). Since 1983-84 the data have been published on a financial year basis. Only calendar year data are available for earlier years. Construction materials are not identified by site of production in the Victorian annual report; the total State data published are sourced to the ABS.

The Queensland Department of Mines annual report (Queensland Department of Mines 1985) provides information on the quantity and value of mineral production by mining district. The mining districts are larger than local government areas but smaller than statistical divisions. Financial year data have been published since 1982-83. Construction materials are included in the production statistics.

In Western Australia the Department of Mines publishes quantity and value of mineral production by mining district, mineral field and

producer (Department of Mines, WA 1985). Data are available for calendar years 1980 to 1985 and financial year 1984-85. Mineral field data are only available for some minerals and some years.

The South Australian Department of Mines and Energy includes only State-wide mineral production (quantity and value) on a calendar year basis in its annual report (Department of Mines and Energy, SA 1985). A map is included indicating major flows of minerals by origin, destination and mode of transport. Unpublished calendar year data were also obtained showing production of principal mining operations from 1977 to 1982 and mineral movements ex mine sites for the calendar years 1983 to 1985 (Department of Mines and Energy, SA n.d.a, n.d.b).

The annual report of the Tasmanian Department of Mines includes only total State mineral production figures, including construction materials (Department of Mines, Tasmania 1985). The data are on a financial year basis.

The Northern Territory Department of Mines and Energy collects mineral production information by company and not by mine site although the locations of mines can be readily obtained. There is generally only one producer of each mineral produced in the Northern Territory so it was possible to identify production figures with individual sites. The annual report contains quantity and value statistics for each mineral produced in the Territory on a calendar year basis (NT Department of Mines and Energy 1985).

NATMAP

The Division of National Mapping, Department of Resources and Energy (NATMAP), produces various maps showing mineral reserves, production and flows. The data on which these maps are based are collected from a number of sources, and NATMAP now has significant in-house knowledge of mineral flows in Australia.

COAL BOARD REPORTS

The Queensland Coal Board (1985) and the Joint Coal Board (1985) publish a variety of statistics on coal production, sales and transport. Production statistics are by mine site while tonnes consigned by mode are given by mining district.

CHAPTER 3 MINERAL OVERVIEW

This chapter provides a broad overview of each mineral included in this review. The major sites and production processes are described together with the destination and use of the output where this information was available. Transport mode is identified where applicable. Production figures for 1983-84 are shown in Table 3.1 for minerals included in the review. Quantities of minerals included in the ABS mineral production statistics but not included in the review are shown in Table 3.2.

Discrepancies may occur in the total production figures shown in Table 3.1 and in Tables 3.3 to 3.21 due to the different data sources used. Data provided by some of the sources are for calendar years while other sources publish fiscal year data. The maps which are included in this chapter have been reproduced from data provided by NATMAP. As they were produced independently of the review, using different data sources in some instances, the mineral movements shown may not correspond exactly to the movements described in this Paper.

FUELS

The major flows of crude oil, black coal and brown coal as at mid-1984 are shown in Figure 3.1. Natural gas and gas liquids pipelines are also shown on the map although these fuels were excluded from the review.

Crude oil

Production of crude oil in Australia by location is shown in Table 3.3. The major area of production is the Gippsland Shelf in Bass Strait. The crude oil is piped from the drilling rigs to Westernport Bay; from Westernport it is shipped either to Australian or overseas refineries (mainly New Zealand), or is transported by pipeline to refineries at Altona (Melbourne) and Geelong.

Oil is produced in Western Australia at Blina-Sundown (east of Broome), Barrow Island and Dongara. Blina-Sundown oil is transported to Broome by pipeline and truck (approximately 30 kilometres each), and then taken by ship to the refinery at Kwinana. Barrow Island oil

is shipped to refineries in Perth, Geelong, Sydney and Adelaide. Dongara oil is trucked to the Kwinana refinery.

TABLE 3.1 PRODUCTION OF MINERALS INCLUDED IN THE REVIEW: AUSTRALIA, 1983-84

<i>Mineral</i>	<i>Units</i>	<i>Quantity</i>
Fuels		
Oil	mega litres	26 826
Black coal	'000 tonnes	116 347
Brown coal	'000 tonnes	33 245
Metals		
Iron ore	'000 tonnes	76 478
Bauxite	'000 tonnes	13 159 ^a
Nickel ore	'000 tonnes	1 118
Nickel concentrate	'000 tonnes	506
Mineral sands (concentrate)	'000 tonnes	1 624
Manganese	'000 tonnes	1 370
Lead ore	'000 tonnes	47
Lead concentrate	'000 tonnes	709
Copper ore	tonnes	40 371
Copper concentrate	'000 tonnes	836
Zinc ore	tonnes	27 379
Zinc concentrate	'000 tonnes	1 147
Lead-copper concentrate	tonnes	20 835
Lead-zinc concentrate	tonnes	37 932
Uranium concentrate	tonnes	5 098
Non-metallic minerals		
Limestone	'000 tonnes	10 333
Dolomite	'000 tonnes	618
Clay	'000 tonnes	13 498
Salt	'000 tonnes	5 441
Silica	'000 tonnes	2 060
Gypsum	'000 tonnes	1 869
Phosphate rock	tonnes	12 137
Talc (incl. steatite)	'000 tonnes	176

a. Figure does not include unpublished Western Australian production.

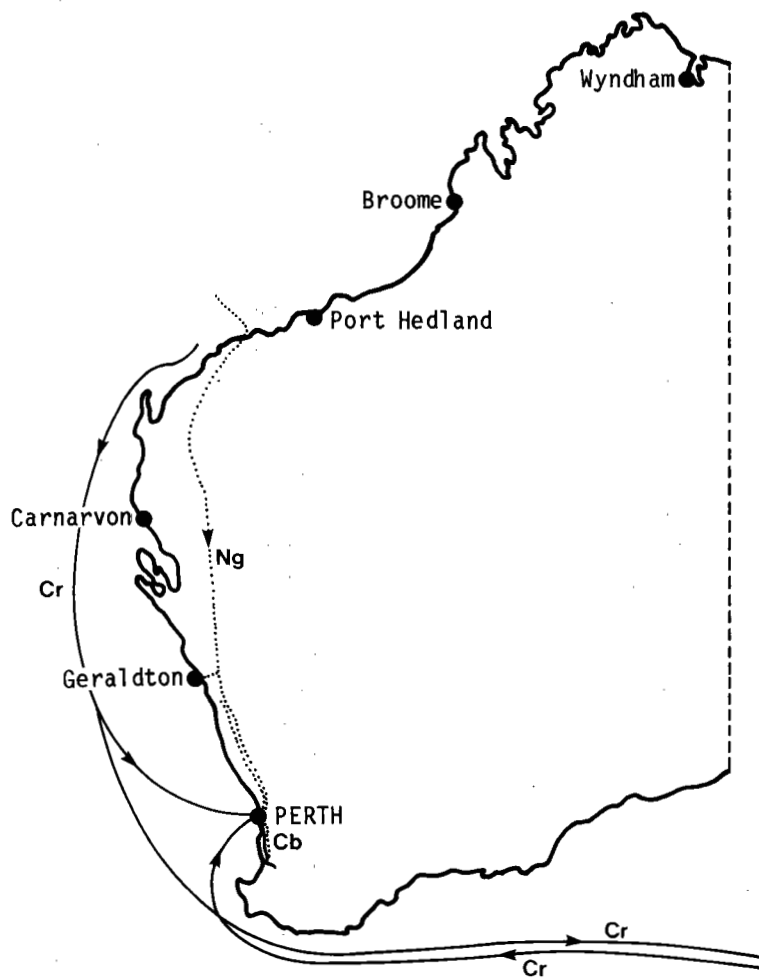
Sources ABS (1986b). Department of Mineral Resources, NSW (1985). Department of Mines and Energy, SA (1985). NT Department of Mines and Energy (1985). Queensland Department of Mines (1985).

TABLE 3.2 PRODUCTION OF MINERALS NOT INCLUDED IN THE REVIEW:
AUSTRALIA, 1983-84

<i>Mineral</i>	<i>Units</i>	<i>Quantity</i>
Fuels		
Gas	giga litres	15 424 ^a
Briquettes	'000 tonnes	760
Metals		
Antimony concentrate	tonnes	473
Gold bullion	kg	33 790 ^b
Gold concentrate	tonnes	1 791
Gold ore	tonnes	442
Iron oxide	tonnes	50 479 ^c
Molybdenum concentrate	tonnes	24
Tantalite-columbite concentrate	tonnes	92
Tin concentrate	tonnes	16 448
Tin-copper concentrate	tonnes	1 618
Tungsten concentrate	tonnes	3 300
Other metallic minerals	tonnes	1 755
Non-metallic minerals		
Barite	tonnes	17 758
Felspar (incl. cornish stone)	tonnes	764 ^d
Lithium ores	tonnes	4 593
Magnesite, crude	tonnes	31 529 ^d
Peat	tonnes	5 355 ^d
Pebbles for grinding	tonnes	3 ^c
Perlite	tonnes	3 785
Pyrophyllite	tonnes	7 189
Sillimanite	tonnes	287
Vermiculite	tonnes	298
Other non-metallic minerals	tonnes	2
Construction materials		
Dimension stone	'000 tonnes	29 239
Crushed and broken stone	'000 tonnes	55 407
Sand	'000 tonnes	24 760
Gravel	'000 tonnes	14 612

- a. Gas includes natural gas, ethane, propane and butane production.
b. Figure does not include unpublished Northern Territory production.
c. Figure does not include unpublished Tasmanian production.
d. Figure does not include unpublished Western Australian production.

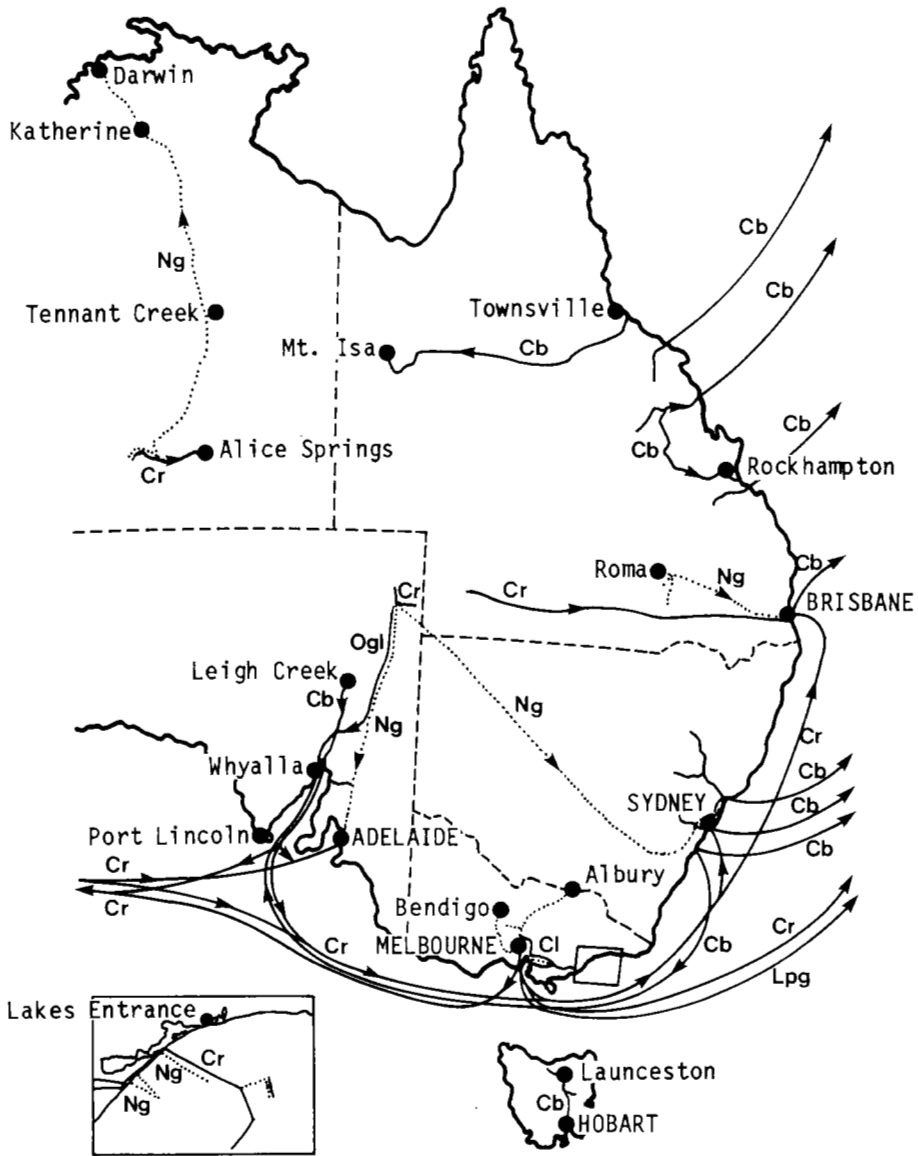
Source ABS (1986b).



Cr Crude oil
Cb Black coal
Ng Natural gas

Source NATMAP (1987a).

Figure 3.1a Major fuel mineral flows: Australia, 1984



- Cr Crude oil
- Cb Black coal
- Cl Brown coal
- Ng Natural gas
- Lpg Liquified petroleum gas
- Ogl Oil and gas liquids

Source NATMAP (1987a).

Figure 3.1b Major fuel mineral flows: Australia, 1984

TABLE 3.3 PRODUCTION OF CRUDE OIL BY LOCATION: 1980 TO 1985
('000 tonnes)^a

<i>Location</i>	<i>1980</i>	<i>1981</i>	<i>1982</i>	<i>1983</i>	<i>1984</i>	<i>1985</i>
Victoria						
Bass Strait	16 312	17 019	16 115	na	(19 207)	(21 166)
Queensland						
Jackson	..	..	..	(4)	(143)	(894)
Moonie ^b	68	65	na	(63)	(65)	(78)
Western Australia						
Blina-Sundown	..	..	3	na	50	(35)
Barrow Island	1 285	1 138	1 005	1 000	979	(933)
Dongara	14	13	14	9	7	(5)
South Australia						
Moomba	..	..	..	585	840	na
Northern Territory						
Mereenie	..	..	..	..	21	na
Total^c	17 058	17 363	16 522	18 600	22 003	na

a. Conversion factor: 1 kilolitre = 0.8 tonnes. Excludes condensates.

b. Includes figures for Roma.

c. The source of these figures is the Department of Resources and Energy.

.. Not applicable.

na Not available.

Notes 1. Figures in parentheses refer to the fiscal year ending 30 June of the specified calendar year.

2. Figures do not add to totals due to the different sources used.

Sources Department of Mines and Energy, SA (1985). Department of Mines, WA (1985). Department of Resources and Energy (1987). NT Department of Mines and Energy (1985). Office of Minerals and Energy, Vic (1985). Queensland Department of Mines (1985).

Crude oil is produced in South Australia in the Cooper Basin (Moomba) and is piped to Port Bonython for shipment to Australian refineries. Crude oil is also produced at Jackson (in the Queensland part of the Cooper Basin) and is piped to Brisbane via Moonie where small

quantities of oil are produced. A small quantity of oil is also produced at the Roma gas field in Queensland and until May 1986 was trucked to the Roma oil refinery (the average length of haul was 30 kilometres). This movement was not included in the database. The oil is now trucked about 200 kilometres to the Moonie pipeline.

In 1984 production of oil commenced in the Amadeus Basin, west of Alice Springs. This oil is piped from Mereenie to Alice Springs and is then railed to Adelaide.

Imports of crude oil represent about 25 per cent of Australia's crude oil production. Imported oil is landed at Sydney, Melbourne, Brisbane, Perth and Adelaide for refining.

Black coal

Black coal is mined in all States of Australia except Victoria, however, New South Wales and Queensland dominate production (see Table 3.4). All export coal is shipped from New South Wales and Queensland ports. Most land movements to ports are by rail, although some movements to both Newcastle and Port Kembla are by road. Road movements were estimated based on information in the reports of the Joint Coal Board (1985). Power stations, which account for 75 per cent of domestic consumption, receive most of their coal by conveyor or road from local production sites. These movements were not included in the database.

In June 1985, New South Wales had 89 coal mines in production out of a national total of 150. Only five New South Wales mines featured in the national top 20 in terms of raw production in 1984-85. Most New South Wales coal is railed to either Newcastle, Port Kembla or Sydney. Major consumers in the State are the State Electricity Commission (SEC) power stations, the iron and steel industry, the cement industry and the metallurgical coke industry. Shipments from Port Kembla are made to the Whyalla steelworks. Exports are mainly to Japan (19.3 million tonnes in 1984-85) with large tonnages also exported to Europe (15m), Korea (5.3m), Taiwan (2.7m) and Hong Kong (1.3m) in 1984-85.

Queensland had 52 coal mines in production in June 1985, and 14 of the top 20 producers in 1984-85. Most production is railed to the coal ports at Abbot Point, Hay Point, and Dalrymple Bay for export or to Gladstone and Brisbane for local consumption or shipment to Australian and overseas destinations. Major consumers in Queensland are the power stations, the aluminium smelter at Gladstone, the Greenvale nickel smelter and the cement works at Gladstone, Bathurst and Bowen. Japan is the major importer of Queensland coal (24.6 million tonnes in

TABLE 3.4 PRODUCTION OF BLACK COAL BY LOCATION: 1980-81 TO 1984-85
('000 tonnes)

<i>Location</i>	<i>1980-81</i>	<i>1981-82</i>	<i>1982-83</i>	<i>1983-84</i>	<i>1984-85</i>
New South Wales					
South Maitland	1 544	1 349	1 148	1 193	1 066
Singleton-Nth West	18 649	18 482	22 780	24 464	26 799
Newcastle	13 975	14 917	17 561	16 847	16 381
Western District	6 320	7 767	10 062	9 521	11 277
Burraborang Valley	5 079	4 045	3 264	3 223	3 093
South Coast	12 725	13 258	12 641	11 285	11 418
Queensland					
West Moreton	2 676	2 765	3 081	2 937	2 990
Darling Downs	9	10	12	10	3
Nanango	..	..	..	603	1 153
Maryborough	17	13	16	17	12
Kianga-Moura	2 261	2 606	1 903	2 251	2 019
Callide	2 444	2 313	3 542	3 737	3 002
Blair Athol	100	96	132	934	3 668
Blackwater	8 098	9 801	11 235	15 399	18 041
Mackay	16 225	15 550	14 506	16 957	21 561
Bowen	1 018	1 122	1 383	1 192	1 838
South Australia^a					
Leigh Creek	1 737	1 425	1 435	1 269	1 757
Western Australia^a					
Collie	3 127	3 434	3 903	3 942	3 673
Tasmania^a					
Duncan	305	253	321	276	296
Total^a	96 074	99 560	107 768	116 346	118 267

a. The source of these figures is ABS.

.. Not applicable.

Note Figures do not add to totals due to the different sources used.

Sources ABS (1986b). Joint Coal Board (1985). Queensland Coal Board (1985).

1984-85) with Europe (12.6m), Korea (1.9m) and Taiwan (1.8m) also recording imports of more than a million tonnes of Queensland coal in 1984-85.

In South Australia, black coal is produced at Leigh Creek, which is 550 kilometres north of Adelaide. The coal is railed to Port Augusta for use in electricity generation. In Western Australia coal is produced at Muja and other mines near Collie, 50 kilometres north-east of Bunbury. The coal is used either in local power generating facilities or is railed to Kwinana. Tasmanian production is centered at Duncan in the Fingal Valley on the east coast of Tasmania. The coal is used mainly in the cement and paper industries. Major movements are to Burnie, Boyer and Railton by rail.

Brown coal

Australia's only brown coal is produced in Victoria (see Table 3.5) mainly in the Latrobe Valley east of Melbourne. The mines are operated by the SEC which uses the coal to generate electricity in that area. The SEC operates railways to move the coal from the Morwell and Yallourn mines to the power stations. Some coal is carried by V/Line to Melbourne and other places in Victoria.

There are two other brown coal mines in Victoria. One is at Anglesea, owned by Alcoa, which uses the coal on-site to generate electricity for its Point Henry aluminium smelter. The other is at Bacchus Marsh. The coal from Bacchus Marsh is railed to Clifton Hill (Melbourne).

TABLE 3.5 PRODUCTION OF BROWN COAL BY LOCATION: 1980 TO 1984
(*'000 tonnes*)

<i>Location</i>	<i>1980</i>	<i>1981</i>	<i>1982</i>	<i>1983</i>	<i>1984</i>
Victoria					
Morwell & Yallourn	31 361	31 482	36 311	32 710	(31 834)
Yallourn North	227	217	221	230	(219)
Anglesea	1 190	1 163	1 186	1 184	(1 066)
Bacchus Marsh	115	97	102	67	(80)
Total	32 893	32 959	37 820	34 191	(33 199)

Note Figures in parentheses refer to the fiscal year ending 30 June 1984.

Source Office of Minerals and Energy, Vic (1985).

Brown coal deteriorates rapidly so that production and consumption are likely to be the same in any one year. There is little likelihood of stockpiling.

METALS

Figure 3.2 shows the major flows of metallic minerals in Australia. The mineral flows included do not correspond exactly to those discussed in this section due to the different data sources used. In particular, flows of mineral sands are excluded from Figure 3.2 as mineral sands are classified as non-metallic minerals by NATMAP.

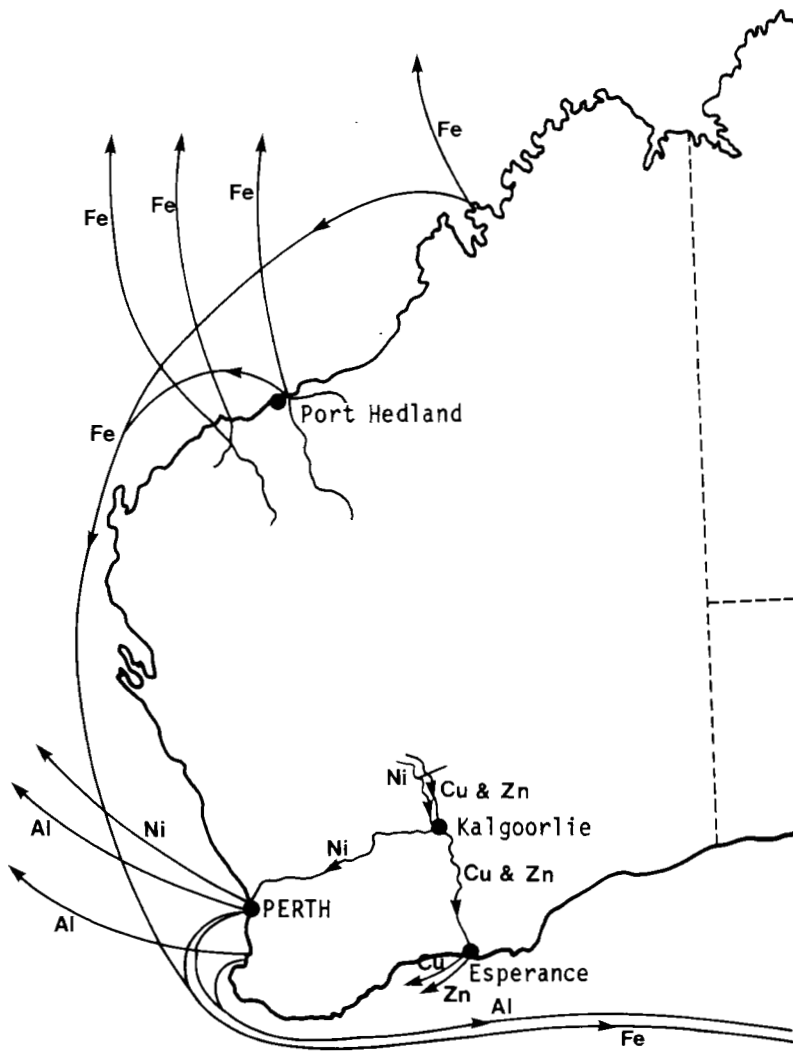
Iron ore

Iron ore is mined in three States at the locations indicated in Table 3.6. There are five mines (Deepdale, Paraburdoo, Mount Tom Price, Mount Whaleback and Shaygap-Sunrise Hill) in the Pilbara region of Western Australia which account for over 90 per cent of Australian production. Most of the ore is exported from the Pilbara in an untreated form, however, beneficiation plants to produce iron concentrate are located at Mount Tom Price and Mount Whaleback. The ore and/or concentrate is railed to ports in the Pilbara region for export. A small proportion of the ore is shipped to Australian steelworks. All iron ore and concentrates are carried by rail in the Pilbara region except for the 9 kilometres from Sunrise Hill to the railhead at Shay Gap. This short road movement is not included in the database.

There are three other iron ore mines in Western Australia: Koolyanobbing which closed in 1982; Cockatoo Island which closed in 1984 although the stockpiled ore continued to be shipped from Yampi Sound to the eastern states in 1985; and Koolan Island which continues in operation with most output being exported to Japan, also through Yampi Sound.

In South Australia, iron ore is mined at several sites in the Middleback Ranges west of Whyalla. The ore is railed to Whyalla where it is pelletised and then made into steel either at Whyalla, Port Kembla or Newcastle. Some of the ore also goes to the alloy plant at Bell Bay and a small amount is exported.

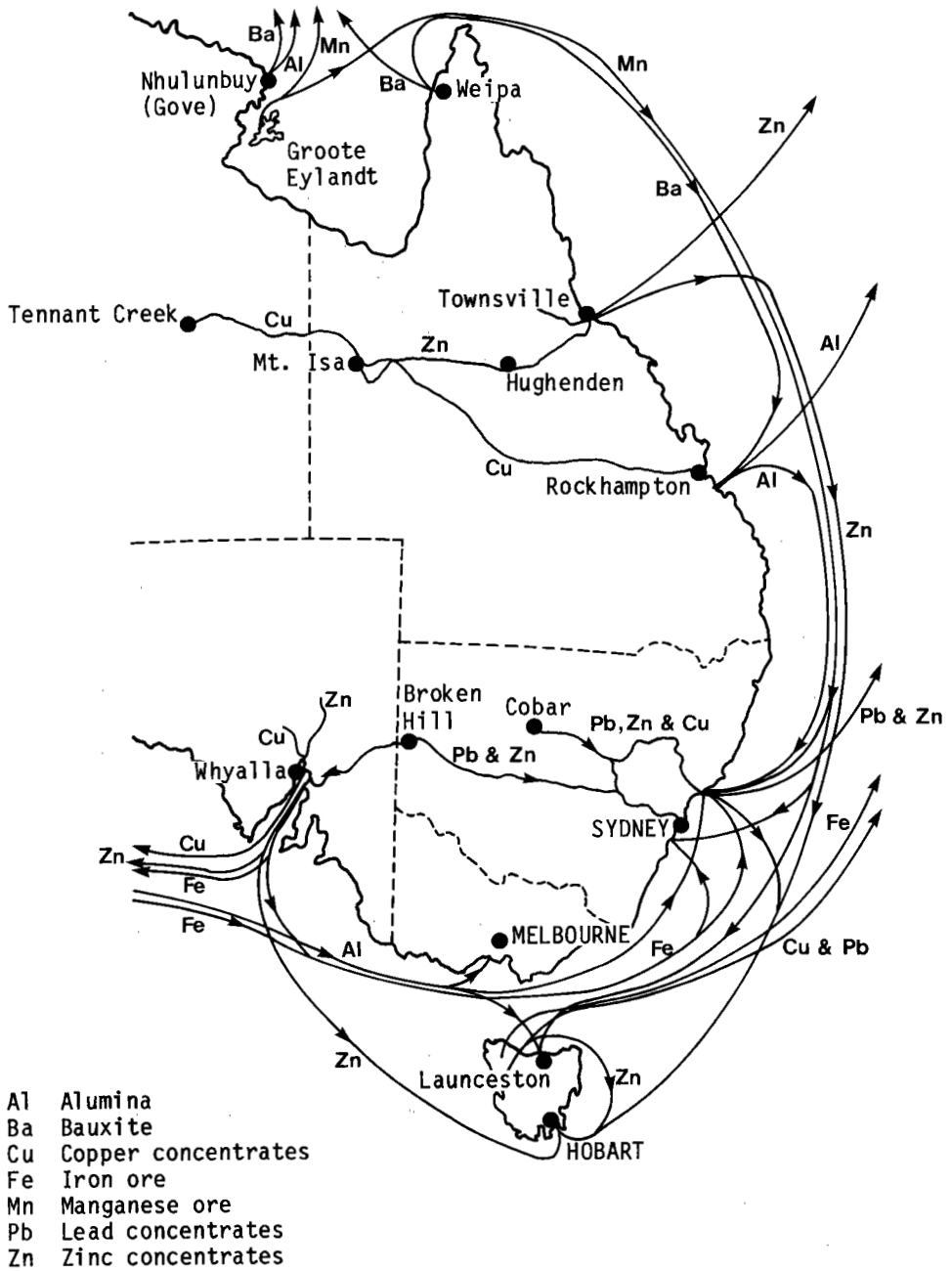
In Tasmania, iron ore is mined at Savage River where it is crushed and formed into a slurry for transport by pipeline to Port Latta. Pellets are made at Port Latta for export to Japan; recently some concentrate has been sold domestically.



- Al Alumina
- Cu Copper concentrates
- Fe Iron ore
- Ni Nickel concentrates
- Zn Zinc concentrates

Source NATMAP (1987b).

Figure 3.2a Major metallic mineral flows: Australia, 1984



Source NATMAP (1987b).

Figure 3.2b Major metallic mineral flows: Australia 1984

TABLE 3.6 PRODUCTION OF IRON ORE BY LOCATION: 1980 TO 1985
(*'000 tonnes*)

<i>Location</i>	<i>1980</i>	<i>1981</i>	<i>1982</i>	<i>1983</i>	<i>1984</i>	<i>1985</i>
Western Australia						
Deepdale	12 138	12 176	13 308	13 002	14 950	(14 645)
Mt Tom Price-						
Paraburdoo	36 397	27 681	27 333	31 273	36 806	(37 598)
Mt Whaleback	27 295	27 436	28 707	22 546	30 902	(29 207)
Shay Gap-						
Sunrise Hill	5 370	5 359	4 895	4 871	4 737	(4 572)
Koolyanobbing	1 658	1 193	734	283	..	..
Cockatoo Island	600	684	679	475	876	(915)
Koolan Island	1 494	774	2 527	2 535	2 360	(2 337)
Total	84 952	75 303	78 183	74 985	90 631	(89 274)
South Australia^a						
Middleback Ranges	2 466	2 456	1 765	1 497	1 765	1 726
Tasmania						
Savage River	(2 192) ^b	(2 203)	(1 994)	(2 294)	(2 103)	na
Total^b	(96 998)	(93 754)	(86 786)	(78 971)	(76 478)	na

a. Figures for 1983 to 1985 are movements ex mine site.

b. The source of these figures is ABS.

.. Not applicable.

na Not available.

Notes 1. Figures in parentheses refer to the fiscal year ending 30 June of the specified calendar year.

2. Figures do not add to totals where different sources have been used.

Sources ABS (1986b). Department of Mines and Energy, SA (n.d.a, n.d.b) Department of Mines, Tas (1985). Department of Mines, WA (1985).

Bauxite

Bauxite is mined at three major locations in Australia: Weipa in North Queensland, Gove in the Northern Territory and the Darling Ranges in Western Australia (see Table 3.7). Bauxite is refined to become alumina which is then smelted to become aluminium. In this review only movements of bauxite and alumina are included.

Bauxite mined at Weipa is moved by either rail or road to the port from where it is shipped to the refinery at Gladstone or exported overseas. Alumina produced at Gladstone is either exported or shipped to one of the five smelters in Australia (Boyne Island, Bell Bay, Point Henry, Kurri Kurri or Tomago)¹ for the production of aluminium.

About half of the bauxite mined at Gove is refined on-site into alumina and the remainder is exported. The alumina produced at Gove is exported.

There are five bauxite mining areas in the Darling Ranges. The bauxite from the Del Park and Huntley mine sites is moved via conveyors to the refinery at Pinjarra. The alumina produced is then railed to Bunbury or Fremantle. The bauxite from Jarrahdale mine goes by rail to the refinery at Kwinana and is then shipped from Fremantle. Both the Willowdale and Mount Saddleback bauxite mines have refineries close by (Wagerup and Worsley respectively). Ore is transferred to the refineries by conveyor systems; the alumina is then transported to the ports of Bunbury and Fremantle by rail and is then shipped to Australian smelters or overseas destinations.

Bauxite is also mined intermittently at Mirboo North in Victoria, and Canyonleigh in New South Wales. The tonnages are small and were not included in the movements database.

Nickel

Nickel is mined in Australia in the Kalgoorlie area of Western Australia and at Greenvale near Townsville in Queensland. Production of nickel ore and concentrate is shown in Table 3.8. Mines in Western Australia are at Kambalda (several sites), Agnew (Leinster), Windarra, Nepean and Carnilya Hill. Concentrating mills are located at Kambalda, Agnew and Windarra. Mining ceased at Nepean in 1983. Ore from Carnilya Hill mines is concentrated at the Kambalda mill. Nickel concentrates from the three mills are then railed to the Kalgoorlie smelter or to Perth. Agnew output is sent by road to the railhead at Leonora. The Kalgoorlie products are railed to Perth for export through the port of Fremantle or for further treatment at the Kwinana refinery. After this final processing stage the nickel products (which were excluded from the review) are exported or are sold domestically.

1. The Portland smelter commenced operation in February 1987.

TABLE 3.7 PRODUCTION OF BAUXITE BY LOCATION: 1980-81 TO 1984-85
(*'000 tonnes*)

<i>Location</i>	<i>1980-81</i>	<i>1981-82</i>	<i>1982-83</i>	<i>1983-84</i>	<i>1984-85</i>
Queensland					
Weipa	(9 444)	(8 694)	5 816	7 961	8 360
Western Australia					
Del Park-Huntley					
Jarrahdale			Distribution not available		
Willowdale					
Mt Saddleback					
Total ^a	12 207	11 907	na	na	18 421
Northern Territory					
Gove	(5 178)	(4 416)	(4 531)	(4 956)	(5 413)
Victoria					
Mirboo North-					
Traralgon	..	..	9	13	na
New South Wales					
Canyonleigh	2	1	1	..	..
Total ^a	25 450	24 690	na	na	na

a. The source of these figures is ABS.
 .. Not applicable.
 na Not available.

Notes 1. Figures in parentheses refer to the calendar year ending 31 December of the specified fiscal year.
 2. Figures do not add to totals due to the different sources used.

Sources ABS (1986b). Department of Mineral Resources, NSW (1985). NT Department of Mines and Energy (1985). Office of Minerals and Energy Vic (1985). Queensland Department of Mines (1985).

Nickel production at Greenvale is about one-third of that in Western Australia. The mined ore is railed to the treatment plant at Yabula, 25 kilometres north of Townsville, from where it is exported. Experiments are underway to determine if imported nickel can be processed at Yabula when the Greenvale deposit is exhausted.

TABLE 3.8 PRODUCTION OF NICKEL (ORE AND CONCENTRATE) BY LOCATION:
1980 TO 1985

('000 tonnes)

<i>Mineral and Location</i>	1980	1981	1982	1983	1984	1985
Nickel ore						
Greenvale(Qld)	(2 163)	(1 947)	(2 231)	(1 711)	(1 118)	(1 809)
Nepean (WA)	87	86	98	19	..	..
Nickel concentrate						
Kambalda (WA)	285	265	302	344	353	334
Emu Rock (WA)	16	..	2	..	..	..
Carnilya Hill (WA)	..	32	25	28	31	34
Leinster (WA)	95	79	77	78	72	69
Windarra (WA)	..	30	51	44	42	49
Total	396	406	457	494	498	486

.. Not applicable.

Note Figures in parentheses refer to the fiscal year ending 30 June of the specified calendar year.

Sources ABS (1986b). Department of Mines, WA (1985).

Mineral sands

Mineral sands produced in Australia include rutile, ilmenite, zircon, monazite, kyanite and Hyti.² Zirconium sands are used mainly in foundry and ceramic applications. Zirconium metal, because of its resistance to corrosion, is used in chemical processing equipment. Other mineral sands are widely used as fluxing agents, furnace lining in steel production or in pigment production.

The largest producing State for mineral sands is now Western Australia (see Table 3.9) where there are major deposits north and south of Perth. To the north, Eneabba sands contain ilmenite, rutile, zircon,

2. Trade name.

TABLE 3.9 PRODUCTION OF MINERAL SANDS (CONCENTRATE) BY LOCATION:
1980-81 TO 1984-85
('000 tonnes)

<i>Location</i>	<i>1980-81</i>	<i>1981-82</i>	<i>1982-83</i>	<i>1983-84</i>	<i>1984-85</i>
New South Wales					
Hawks Nest	71	57	41	22	14
Tomago	81	84	75	87	81
Crescent Head	21	4	..	..	..
Hexham	18	18	..	..	..
Queensland					
Stradbroke Island	(191)	(133)	151	180	270
Western Australia					
Capel	(734)	(607)	(554)	(503)	628
Yoganup	(218)	(217)	(285)	(201)	401
Eneabba	(761)	(453)	(646)	(559)	699
Total^a	2 028	1 948	1 556	1 624	1 939

a. The source of these figures is ABS.

.. Not applicable.

- Notes* 1. Figures in parentheses refer to the calendar year ending 31 December of the specified fiscal year.
2. Figures do not add to totals due to the different sources used.

Sources ABS (1986b). Department of Mineral Resources, NSW (n.d.). Department of Mines, WA (1985). Queensland Department of Mines (1985).

monazite and kyanite; these minerals are extracted on-site, and are railed either to Geraldton for further processing or to the synthetic rutile plant at Capel. The minerals are exported through Geraldton and Perth. To the south, sands are mined at Capel and Yoganup for ilmenite, zircon, monazite, Hyti and Hyti 91. Most of the minerals are railed to Bunbury for export with some going to the titanium plant at Burnie.

The one active mineral sands operation in New South Wales is near Tomago. Rutile, zircon and ilmenite are extracted from the sands. Production ceased at Crescent Head and Hexham in 1981 and at Hawks

Nest in 1983 but treatment of stockpiles continues. All mineral sands are exported from Newcastle.

There is also only one remaining area where mineral sands are mined in Queensland. On North Stradbroke Island rutile and zircon are extracted from sands. Mines on Moreton Island and Fraser Island have been closed for environmental reasons. The minerals are exported through the port of Brisbane.

Manganese

Manganese is presently mined at only one location in Australia; Groote Eylandt in the Northern Territory (see Table 3.10). About 70 per cent of the ore is exported, mainly for use in the steel industry. Japan, Korea and the Union of Soviet Socialist Republics are the three main destinations. Most of the remaining ore is shipped to the Bell Bay (Launceston) alloy plant, where ferromanganese and siliconmanganese are produced, or to New South Wales steel works. Small amounts are also shipped to Darwin for use in the Ranger and Nabarlek uranium mills, to Western Australia for use in bauxite processing and pigment manufacture, and to Burra (South Australia) for use in fertiliser manufacture.

Lead, zinc and silver

Lead, zinc and silver often occur together in ore bodies so are described together in this section. However, the available mineral production data do not identify silver separately from lead and zinc. Silver is therefore excluded from the production data presented in Table 3.11. Copper also occurs in some lead-zinc-silver ore bodies and is considered in the next section.

Ores are mined in New South Wales (Broken Hill, Cobar and Woodlawn), Queensland (Mount Isa), Western Australia (Teutonic Bore), Tasmania (Rosebery and Que River) and the Northern Territory (Woodcutters). The Woodcutters mine commenced operation in the first quarter of 1985-86 and was not included in the review.

There are four mines at Broken Hill accounting for 60 per cent of the New South Wales production. Lead concentrates (containing silver) are produced on-site and most smelting is undertaken at the Broken Hill Associated Smelters Pty Ltd (BHAS) smelter in Port Pirie, with some going to Cockle Creek (Newcastle) and the remainder exported. At Cockle Creek lead bullion is produced which may then be returned to Port Pirie for processing to pure lead or for export. Zinc concentrates are shipped to Risdon or Cockle Creek or are exported.

TABLE 3.10 PRODUCTION OF MANGANESE ORE BY LOCATION: 1980 TO 1984
(*'000 tonnes*)

<i>Location</i>	<i>1980</i>	<i>1981</i>	<i>1982</i>	<i>1983</i>	<i>1984^a</i>
Queensland					
Cloncurry MD	22	38	..	..	..
Northern Territory					
Groote Eylandt	1 998	1 409	1 123	1 370	1 849
Total	2 020	1 447	1 123	1 370	1 849

a. Fiscal year 1984-85.

.. Not applicable.

MD Mining district.

Sources NT Department of Mines and Energy (1985). Queensland Department of Mines (1985).

There are two mines in the Cobar area, the Cobar and Elura mines. Both produce lead-silver and zinc-silver concentrates. The Cobar mine also produces copper. The output from the Cobar mine is railed to Cackle Creek or is exported, while that from Elura goes to the BHAS smelter in Port Pirie.

The lead-silver and zinc-silver concentrates from Woodlawn either receive further processing at Cackle Creek or are exported. The ore mined at Woodlawn also contains copper.

Lead, zinc, silver and copper are contained in ores mined at Mount Isa in Queensland. The ore is milled to produce concentrates which are then refined to bullion on-site. The bullion is then railed to Townsville for export to the United Kingdom.

In Tasmania, ores containing lead, silver, zinc and copper are mined at Rosebery, Hercules and Que River mines. The ore from Que River is trucked 42 kilometres to the Rosebery concentrator. Concentrates are railed to Burnie with lead-silver being exported and zinc concentrates further refined at Risdon.

Mining operations ceased at Teutonic Bore in Western Australia in November 1984 although processing continued through 1984-85 to produce zinc concentrates (containing copper and silver). The concentrates are trucked 60 kilometres to the railhead at Leonora, and from there are railed to Esperance for export to Japan.

TABLE 3.11 PRODUCTION OF LEAD AND ZINC (ORE AND CONCENTRATE) BY
LOCATION: 1980-81 TO 1984-85
('000 tonnes)

<i>Mineral and location</i>	<i>1980-81</i>	<i>1981-82</i>	<i>1982-83</i>	<i>1983-84</i>	<i>1984-85</i>
Lead concentrate					
New South Wales					
Broken Hill	270	285	262	209	227
Cobar	6	7	4	8	5
Elura	..	..	16	45	88
Woodlawn	63	53	38	28	35
Queensland					
Mt Isa	270	331	367	385	372
Tasmania					
	13	28	37	34	37
Total	622	704	724	709	764
Lead ore					
Queensland					
Mt Isa	..	..	36	47	53
Lead-zinc concentrate					
New South Wales					
Broken Hill	10	33	40	38	46
Cobar	..	8	..	..	..
Lead-copper concentrate					
Tasmania					
	22	32	25	21	28
Zinc concentrate					
New South Wales					
Broken Hill	408	481	512	377	442
Cobar	19	17	13	23	13
Elura	..	..	30	88	143
Woodlawn	119	134	117	100	100
Queensland					
Mt Isa	194	258	311	369	396
Western Australia					
Teutonic Bore	10	60	72	59	52

TABLE 3.11 (Cont.) PRODUCTION OF LEAD AND ZINC (ORE AND CONCENTRATE)
 BY LOCATION: 1980-81 TO 1984-85
 ('000 tonnes)

<i>Mineral and location</i>	<i>1980-81</i>	<i>1981-82</i>	<i>1982-83</i>	<i>1983-84</i>	<i>1984-85</i>
Tasmania	95	147	151	131	165
Total	845	1 097	1 206	1 147	1 311
Zinc ore					
South Australia					
Puttapa	..	..	12	27	37

.. Not applicable.

Note Figures for all States except NSW are State totals obtained from ABS.

Sources ABS (1986b). Department of Mineral Resources, NSW (n.d.).

Copper

The major Australian production of copper is at Mount Isa (see Table 3.12) where the ores also contain lead, zinc and silver. Milling and smelting are undertaken on-site and the resulting bullion is railed to Townsville. Copper was also mined in Queensland at Dianne until 1983; some small mines exist in the Cloncurry district, the output from which is treated at Mount Isa (these movements were not included in the movements database).

In New South Wales the ores mined at Cobar and Woodlawn contain copper. Concentrates are produced on-site and smelting is undertaken at Port Kembla.

The major copper production in Tasmania is at the Mount Lyell mine near Queenstown. Copper concentrates (containing silver) are trucked to Rosebery then railed to Burnie for export to Japan. Some copper is also contained in ores mined at Rosebery, Hercules, Que River and Cleveland.

Copper mining has ceased in South Australia. Stockpiles from the Burra mine were processed until March 1983, while stockpile processing continues at Mount Gunson. The concentrates from Mount Gunson are

TABLE 3.12 PRODUCTION OF COPPER (ORE AND CONCENTRATE) BY LOCATION:
1980-81 TO 1984-85
('000 tonnes)

<i>Mineral and location</i>	<i>1980-81</i>	<i>1981-82</i>	<i>1982-83</i>	<i>1983-84</i>	<i>1984-85</i>
Copper concentrate					
New South Wales					
Cobar	18	24	36	34	32
Woodlawn	27	46	48	54	40
Queensland ^a					
Mt Isa	641	659	564	634	675
South Australia					
Mt Gunson	(19)	(41)	(25)	(33)	(20)
Tasmania ^a					
Mt Lyell	81	69	na	91	86
Northern Territory					
Warrego	67 ^a	44 ^a	na	(43)	(6)
Western Australia ^a					
Teutonic Bore	5	31	55	42	45
Copper ore					
Queensland					
Mt Isa	na	na	10	36	28
Cooktown MD	na	na	6	4	na
Total	22^a	23^a	16	40	28

a. These figures are State totals obtained from ABS.
na Not available.
MD Mining district.

Note Figures in parentheses refer to the calendar year ending 31 December of the specified fiscal year.

Sources ABS (1986b). Department of Mineral Resources, NSW (n.d.). Department of Mines and Energy, SA (1985). Queensland Department of Mines (1985). NT Department of Mines and Energy (1985).

transported to Whyalla by road for export to Japan. Mining has also ceased in Western Australia (Teutonic Bore) as noted earlier although processing continued through 1984-85. Some copper is derived from nickel concentrates refined at Kwinana.

At Warrego in the Northern Territory, ores containing copper, silver, gold and bismuth are mined. The copper concentrate was trucked to the Mount Morgan smelter in Queensland until July 1984. Since that time copper cement has been produced at Warrego and sent by road to Alice Springs then by rail to Burra (South Australia) for use in fertiliser manufacture. This movement was not included in the database as details of quantities shipped were not available.

Uranium

There is currently only one active uranium mine in Australia; the Ranger mine near Jabiru in the Northern Territory. The Mary Kathleen mine near Mount Isa closed in 1982. Uranium at Nabarlek was mined on 147 days in 1979 and the stockpiled ore continues to be milled as required for export as shown in Table 3.13. The Ranger mine produces over twice as much uranium concentrate as the Nabarlek stockpile. The uranium concentrate from the two mines is shipped by road to Darwin for export.

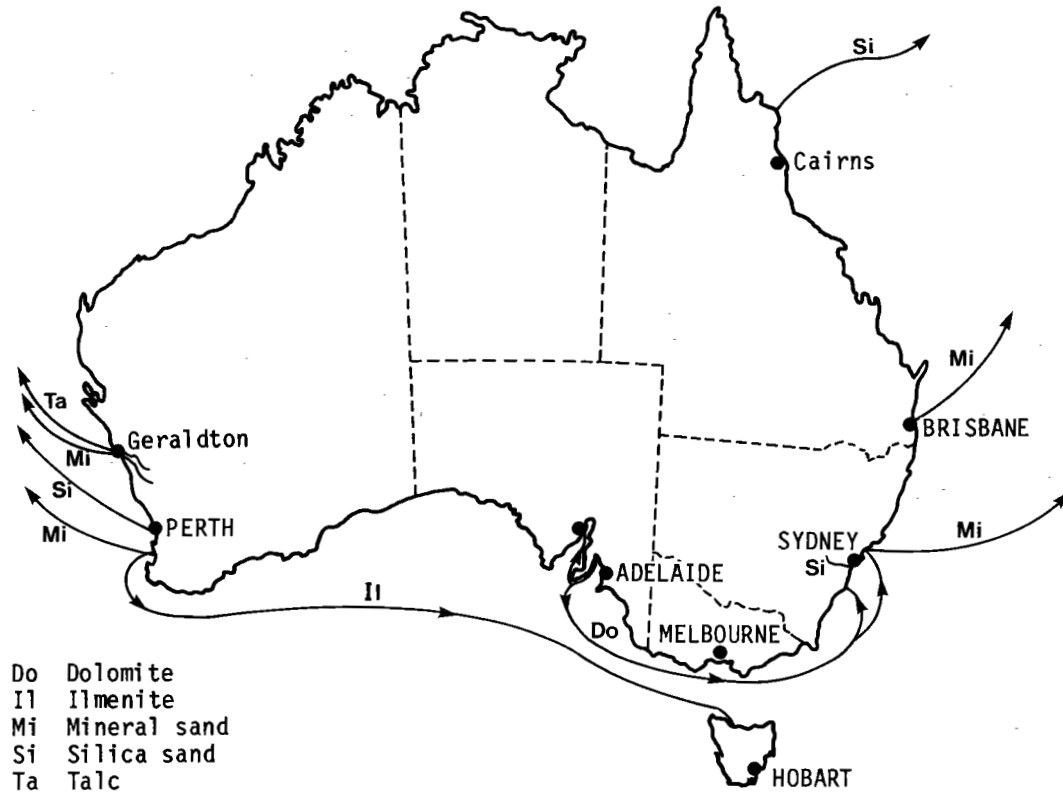
NON-METALLIC MINERALS

Flows of non-metallic minerals as at mid-1984 have been reproduced from data provided by NATMAP in Figure 3.3. The mineral flows included in Figure 3.3 do not correspond exactly to those discussed in this section due to the different data sources used. In particular, mineral sands were classified as metallic minerals for the purposes of this review but are included with non-metallic minerals in the mineral flow data obtained from NATMAP.

Limestone

Over 10 million tonnes of limestone is produced in Australia each year (see Table 3.14) and just under 1 million tonnes is imported. About three-quarters of the limestone is used in cement production, with much of the remainder being used in metal refining and smelting operations and for agricultural purposes.

New South Wales is the largest producer with approximately 3 million tonnes. The major limestone production sites are at Marulan, Portland, Kandos, Attunga and Cow Flat (Bathurst). Marulan limestone is railed to Berrima (for cement clinker manufacture) then to the Maldon cement works. Portland and Kandos limestone is used for cement



Source NATMAP (1987b).

Figure 3.3 Major non-metallic mineral flows: Australia, 1984

TABLE 3.13 PRODUCTION OF URANIUM (CONCENTRATE) BY LOCATION: 1981 TO 1984

(tonnes)

Location	1981	1982	1983	1984
Queensland ^a	(862)	(935)	(350)	..
Northern Territory				
Ranger	na	3 110	2 554	3 768
Nabarlek	na	1 378	1 231	1 330
Total	(1 661) ^a	4 488	3 785	5 098

a. The source of these figures is ABS.

.. Not applicable.

na Not available.

Note Figures in parentheses refer to the fiscal year ending 30 June of the specified calendar year.

Sources ABS (1986b). NT Department of Mines and Energy (1985).

manufacture on-site. Limestone from Attunga is processed on-site into agricultural lime, quicklime or hydrated lime and is then distributed by road, mainly within the northwest of New South Wales. Cow Flat limestone is trucked 14 kilometres to Bathurst for processing into products used for agriculture, paint and plastics. The processed limestone products from Attunga and Bathurst were not included in the movements database.

The Victorian output of limestone is generally over 2 million tonnes per year with the major production sites being Fyansford and Waurin Ponds (Barwon), Merrimans Creek (Central Gippsland), Lilydale (Melbourne) and Buchan (East Gippsland). Over 90 per cent of the limestone is used in cement production and involves little or no transport. Limestone from Fyansford and Waurin Ponds is used in cement production at the mine sites, thus involving no transport. Limestone from Merrimans Creek is trucked 40 kilometres to the Traralgon cement factory. Lilydale limestone is processed on-site into products for use in agriculture. None of the above movements were included in the database. The Buchan limestone is trucked to Nowa Nowa then railed to Maryvale (Morwell) for use in paper manufacture.

Queensland limestone production is approximately 1.5 million tonnes annually with the largest producers at Moreton Bay, Gladstone,

Townsville, Quilpie and Rockhampton mining districts. Most of the output is used for cement and clinker manufacture. There are many smaller producers throughout the State, most of whose production is used for metallurgical flux or for agricultural purposes. Most of these movements involve less than 50 kilometres and were not included in the database.

Over 1 million tonnes of limestone is produced annually in Western Australia. However, details of production by location from the State Department of Mines exclude mining on private lands. The four major production sites for which data are available are Wanneroo, Jandakot, South Coogee and Cleaverville (Pilbara). Limestone from Wanneroo and Jandakot (both suburbs of Perth) is trucked to Rivervale (another Perth suburb) for cement production. Limestone at South Coogee is used on-site for production of cement. No information is available on movements of limestone produced at other locations in Western Australia.

South Australian production of limestone is approximately 1.5 million tonnes annually with almost 70 per cent used in cement manufacture. The largest quarries are at Penrice, Klein Point and Rapid Bay which mainly supply the cement-making plants at Angaston and Birkenhead (Port Adelaide) and the chemical plant at Osborne (Port Adelaide). Smaller quarries are located at Coffin Bay (lime sand for steel-making), Port Parham (shell grit), and Mount Gambier. Limestone from Klein Point and Rapid Bay goes by sea to Adelaide, while that from Port Parham goes by road. Penrice production goes by both road and rail to Adelaide, and Coffin Bay lime sand goes by rail to Proper Bay then by sea to various Australian metals processing plants.

In Tasmania over half a million tonnes of limestone is mined annually for use in cement manufacture, as metallurgical flux and for agricultural purposes. The major production sites are Railton, Mole Creek and Lune River. Information on movements of limestone in Tasmania was not available.

Imports of limestone are mainly from Japan. Imported limestone is carried as backload and is of premium quality for use in the steel industry.

Dolomite

Over 70 per cent of the dolomite mined in Australia is produced at Ardrossan in South Australia. Production of dolomite is shown in Table 3.15. Dolomite from Ardrossan is mainly used as flux in steel blast furnaces and is shipped to Newcastle, Port Kembla, Launceston

TABLE 3.14 PRODUCTION OF LIMESTONE BY LOCATION: 1980-81 TO 1984-85
('000 tonnes)

Location	1980-81	1981-82	1982-83	1983-84	1984-85
New South Wales					
Attunga	47	63	52	81	47
Yessabah-Sherwood	6	13	10	11	12
Mt Buckaroo	..	..	..	6	8
Marulan	2 739	2 629	2 273	2 157	2 336
Wombeyan Caves	19	22	31	25	42
Pretty Gully-Tablum	40	36	23	27	2
Portland	214	178	158	102	102
Cow Flat	5	34	47	77	86
Kandos	533	535	509	536	578
Orange MD	2	4	3	-	4
Total	3 605	3 514	3 106	3 022	3 217
Victoria^a					
Melbourne	na	na	76	na	na
Barwon	na	na	1 777	na	na
South-western	na	na	67	na	na
East Gippsland	na	na	25	na	na
Central Gippsland	na	na	192	na	na
Central Highlands	na	na	1	na	na
Total	2 351	2 163	2 143	1 459	na
Queensland					
Bowen MD	(15)	(14)	8	24	13
Cloncurry MD	(81)	(114)	99	115	110
Gladstone MD	(275)	(108)	529	647	700
Gympie MD	(6)	(8)	11	13	12
Herberton MD	..	..	2	2	3
Mackay MD	..	..	2	4	1
Mareeba MD	(19)	(24)	3	2	18
Mt Isa MD	(2)	-	-	28	6
Nanango MD	(1)	(12)	9	11	12
Rockhampton MD	(254)	(241)	283	289	322
Stanthorpe MD	..	..	8	19	41
Townsville MD	(311)	(354)	352	427	379
Warwick MD	(7)	(6)	10	10	12
Total	1 943^b	2 367^b	1 315	1 591	1 630

TABLE 3.14 (Cont.) PRODUCTION OF LIMESTONE BY LOCATION: 1980-81 TO 1984-85

('000 tonnes)

Location	1980-81	1981-82	1982-83	1983-84	1984-85
Western Australia^c					
Wanneroo	(73)	(78)	(143)	(140)	197
Kwinana	(149)	(201)	(123)	na	na
Jandakot	(305)	(339)	(238)	(168)	na
Cleaverville	(8)	(9)	(9)	(9)	6
Others	(73)	(10)	(1)	(29)	6
Total^b	1 259	1 834	1 253	na	na
South Australia^d					
Penrice	(900)	(700)	(984)	(538)	(1 101)
Klein Point	(775)	(670)	(742)	(690)	(243)
Port Parham	(8)	(16)	(17)	(16)	(13)
Caroline	(2)	(4)	(26)	(24)	(25)
Rapid Bay	(357)	(387)	(214)	(212)	(77)
Coffin Bay	(55)	(63)	(27)	(28)	(13)
Mt Gambier	(9)	(4)	(8)	(14)	na
Total^b	2 019	2 120	1 996	1 583	1 716
Tasmania^b	744	841	798	607	802
Total^b	11 894	12 790	na	10 333	na

- a. Production by statistical division available in 1982-83 only.
b. The source of these figures is ABS. The figures are collected independently of the State mines departments, therefore, State figures by location may not add up to the ABS totals.
c. Figures represent production of limestone for building, burning and agricultural purposes only.
d. Figures for 1983 and 1984 are movements ex mine site. Port Parham production is shell grit and Coffin Bay production is lime sand.
.. Not applicable.
- Less than 500 tonnes.
na Not available.
MD Mining district.

Note Figures in parentheses refer to the calendar year ending 31 December of the specified fiscal year.

Sources ABS (1986b). Department of Mineral Resources, NSW (n.d.). Department of Mines and Energy, SA (n.d.a, n.d.b). Department of Mines, WA (1985). Office of Minerals and Energy, Vic (1985). Queensland Department of Mines (1985).

TABLE 3.15 PRODUCTION OF DOLOMITE BY LOCATION: 1980-81 TO 1984-85
(*'000 tonnes*)

<i>Location</i>	<i>1980-81</i>	<i>1981-82</i>	<i>1982-83</i>	<i>1983-84</i>	<i>1984-85</i>
New South Wales					
Mt Knowles	na	na	2	2	2
Mudgee	2	2	na	na	na
Queensland					
Ipswich	(21)	(20)	17	20	18
Nanango	na	na	10	4	6
South Australia ^a					
Ardrossan	(772)	(693)	(525)	(426)	(452)
Tantanoola	(31)	(33)	(39)	(20)	(30)
Iron Baron	na	na	na	na	(70)
Total ^b	822	617	483	570	588
Tasmania ^b					
Smithton	10	14	18	22	15
Total ^b	854	653	530	618	629

a. Figures for 1983 and 1984 are movements ex mine site.

b. The source of these figures is ABS. Figures do not add to totals due to the different sources used.

na Not available.

Note Figures in parentheses refer to the calendar year ending 31 December of the specified fiscal year.

Sources ABS (1986b). Department of Mineral Resources, NSW (n.d).
Department of Mines and Energy, SA (n.d.a, n.d.b).
Queensland Department of Mines (1985).

and Whyalla. Other significant production of dolomite in South Australia occurs at Tantanoola and Iron Baron; the former goes by rail to Dandenong for glass manufacture and the latter is railed to Whyalla for use in the blast furnaces.

Dolomite is produced in small amounts in New South Wales, Queensland and Tasmania. Much of this dolomite is used for local agricultural purposes (as an additive to fertilisers) or in glass manufacture and was not included in the movements database.

Clay

Various types of clay are produced in Australia. The main ones are brick clay and shale, and cement clay and shale (over 90 per cent of total production) which are used for brick and tile making, and in the manufacture of Portland cement. These types of clay are generally mined close to major consuming centres such as large metropolitan areas. They are not included in the review owing to the difficulty of identifying individual mine sites.

Other clay varieties (bentonite, kaolin, ball clay, halloysite and refractory clays) are produced in all States in Australia as shown in Table 3.16. In New South Wales approximately 50 000 tonnes are produced annually at Scone, Home Rule, Mudgee, Gulgong, Coorabin-Oaklands and Wingen. Half the bentonite mined at Scone and all the halloysite mined at Wingen are processed in Newcastle; the other half of the Scone clay is processed in Sydney. The kaolin mined at Coorabin-Oaklands (near Albury) is processed at Mount Egerton in Victoria, while that from Home Rule, Mudgee and Gulgong is processed in Gulgong. All clay movements in New South Wales are by road.

In Victoria over 80 000 tonnes of clay were produced in 1984 at Greenwald, Pittong, Rowsley, Axedale, Lal Lal and Heyfield. The kaolin mined at Pittong is processed on-site and from the other sites is moved by road for processing at Mount Egerton.

Queensland production of clays is approximately 30 000 tonnes per year. The bentonite mined at Miles (in the Roma mining district) has been processed on-site since 1984. Prior to that, half the bentonite was processed in Brisbane. Approximately 5000 tonnes per year of the bentonite is trucked to Geelong for processing. A small quantity of kaolin (approximately 3000 tonnes per year) is mined at Kingaroy in the Nanango mining district and was not included in the database.

Most clay produced in Western Australia is brick clay and was therefore excluded from the review. Kaolin is mined at Greenbushes, Goomalling and Mount Kokeby in small quantities which were not included in the movements database.

Clay production in South Australia totalled 6000 tonnes in 1984-85. Kaolin, ball clay and refractory clays are mined at Mount Crawford and Birdwood in the Adelaide Hills, while refractory clays are also mined at Cromer. Clays from Mount Crawford and Birdwood are transported by road to Beverley (Adelaide) for processing. Production figures for individual locations in South Australia are not available.

Approximately 15 000 tonnes of kaolin is mined per year in Tasmania but data on the location of mine sites is not available. Rail data from Australian National indicates that 30 000 tonnes of clay were shipped from Tonganah to Burnie in 1984-85.

Salt

About 80 per cent of Australia's salt production occurs in Western Australia. Salt is also mined in Victoria, Queensland and South Australia (see Table 3.17). The major Western Australian mines are in the Pilbara region at Dampier, Lake MacLeod, (Port of Carnarvon), Leslie (Port Hedland) and Useless Loop (Port of Carnarvon). Most salt produced at these mines is exported to Japan and South East Asia, with a small quantity of the Leslie output being used domestically. Mines at Lake Deborah (Koolyanobbing) and Pink Lake (Esperance) together produce about 20 000 tonnes per year for domestic consumption. Salt from these two mines is railed to Coogee (Fremantle) for refining.

Salt is mined in Victoria at various sites on Port Phillip and Corio

TABLE 3.16 PRODUCTION OF CLAY BY LOCATION: 1980-81 TO 1984-85
(tonnes)

<i>Location</i>	<i>1980-81</i>	<i>1981-82</i>	<i>1982-83</i>	<i>1983-84</i>	<i>1984-85</i>
New South Wales					
Scone	3 933	5 519	4 261	3 732	3 448
Home Rule	10 294	7 396	13 488	8 601	9 837
Mudgee	13 622	2 956	1 559	na	na
Gulgong	479	5 619	6 307	29 977	11 323
Coorabin-Oaklands	16 737	13 905	10 083	9 801	9 213
Wingen	17 605	14 780	10 350	7 910	10 285
Total	62 670	50 175	46 048	60 021	44 106
Victoria					
Greenwald	na	(3 020)	(228)	(1 000)	(521)
Pittong	(465)	(24 767)	(22 046)	(26 349)	(29 603)
Lal Lal	(7 773)	(7 021)	(6 862)	(7 322)	(7 622)
Heyfield	(478)	(642)	(443)	(457)	(317)
Axedale	(2 599)	(4 118)	(6 658)	(6 975)	(27 669)
Rowsley	(25 071)	na	na	na	(18 389)
Total	(36 386)	(39 568)	(36 237)	(42 103)	(84 121)

TABLE 3.16 (Cont.) PRODUCTION OF CLAY BY LOCATION: 1980-81 TO 1984-85
(tonnes)

Location	1980-81	1981-82	1982-83	1983-84	1984-85
Queensland					
Nanango MD	(3 848)	(3 220)	2 881	3 116	3 489
Roma MD	(3 510)	(17 426)	34 291	27 946	27 401
Maryborough MD	na	na	na	96	na
Ipswich MD	na	na	8 000	na	na
Ingham MD	(150)	(153)	150	na	na
Toowoomba MD	(20)	na	na	na	na
Total	(7 528)	(20 799)	45 322	31 158	30 890
Western Australia					
Greenbushes	na	na	na	na	2 000
Goomalling	(1 131)	(946)	(1 176)	(994)	(978)
Mt Kokeby	(163)	(440)	(235)	(169)	na
Total	(1 294)	(1 386)	(1 411)	1 163	na
South Australia ^a	7 000	9 000	13 000	5 000	6 000
Tasmania ^a	22000	18 000	15 000	na	na

a. The source of these figures is ABS.

na Not available.

MD Mining district.

Notes 1. Figures in parentheses refer to the calendar year ending 31 December of the specified fiscal year.

2. Figures represent production of bentonite, kaolin, ball clay, halloysite and refractory clays only.

Sources ABS (1986b). Department of Mineral Resources, NSW (n.d.). Department of Mines, WA (1985). Office of Minerals and Energy, Vic (1985). Queensland Department of Mines (1985).

Bays and at Lake Tyrell. All salt produced in Victoria is refined at Geelong.

The two major mines in Queensland are at Bajool, south of Rockhampton, where up to 200 000 tonnes per year are produced. The salt from one mine is shipped from Port Alma to Sydney and overseas destinations for use in chemical manufacture. Salt from the other mine is used in the food processing and hide tanning industries. Eighty per cent of this

TABLE 3.17 PRODUCTION OF SALT BY LOCATION: 1980 TO 1985
('000 tonnes)

Location	1980	1981	1982	1983	1984	1985
Victoria ^a	(73)	(74)	(78)	(57)	(111)	(92)
Queensland						
Bajool	239	202	na	(230)	(187)	(198)
Western Australia						
Dampier						(2 055)
Lake MacLeod						(742)
Leslie		Distribution not available				(1 435)
Useless Loop						(591)
Lake Deborah						na
Pink Lake						na
Total	(4 248) ^a	(5 742) ^a	(3 989) ^a	(4 154) ^a	(4 473) ^a	(4 823)
South Australia ^b						
Dry Creek	549	574	549	564	538	531
Lake Macdonnell	76	16	3	33	24	66
Langhorne Creek	2	6	4	2	2	3
Price	81	64	61	52	54	80
Lochiel	24	52	22	18	15	16
Whyalla	81	40	43	42	69	43
Total	813	752	682	711	702	739
Total ^a	(5 335)	(6 799)	(4 985)	na	na	na

a. The source of these figures is ABS.

b. Figures for 1983 to 1985 are movements ex mine site.

na Not available.

Notes 1. Figures in parentheses refer to the fiscal year ending 30 June of the specified calendar year.

2. Figures do not add to totals where different sources have been used.

Sources ABS (1986b). Department of Mines and Energy, SA (n.d.a, n.d.b). Department of Mines, WA (1985). Queensland Department of Mines (1985).

salt is trucked to Brisbane with the remainder going to various other locations in Queensland and northern New South Wales. Figures are not available for these movements. Salt for domestic consumption (approximately 10 000 tonnes) is extracted from seawater at Bowen and was not included in the movements database.

The bulk of the salt produced in South Australia is from Dry Creek and is used in nearby chemical works, which does not involve a major transport movement. Other production sites are at Price, Lake Macdonnell, Whyalla, Lochiel and Langhorne Creek. Salt from Price, Whyalla and Lochiel is transported by road to Adelaide and the salt from Lake Macdonnell is moved by rail to Thevenard. Some of the salt is then sent interstate or overseas by ship. In 1984-85 some salt from Price went to Ardrossan and then to Hobart and overseas.

Silica

Silica occurs as quartz, quartzite, silica sand, sandstone and shale ash and is mainly used in glass making and foundry applications. The production figures in Table 3.18 exclude silica sand and sandstone used for construction, and gemstones and flint pebbles for grinding purposes. In general, production figures are not available for the various forms of silica (for example, sand as opposed to quartz).

Nearly half a million tonnes of silica is produced in New South Wales each year. The major production site is Anna Bay with the output being trucked to Newcastle for export. Marrangaroo produces industrial grade sands which are trucked to the Port Kembla steel works. Foundry sands are produced at Cronulla and Londonderry for use in the Sydney region (these generally intrazonal movements were not included in the movements database).

Victorian production of silica is almost entirely from sand mined at Lang Lang. About 400 000 tonnes per year is produced, which is mainly railed to Melbourne.

The major silica sand mining operations in Queensland are at Cape Flattery (near Cooktown), Stradbroke Island and Moreton Bay (Brisbane). The output from Cape Flattery is exported and the Brisbane production is used locally. Silica is also mined at Warrigal and Cloncurry for use as flux in smelting and refining at Mount Isa. A small amount of silica is also mined at Bundaberg. Only the Cape Flattery production (over half a million tonnes) was included in the movements database.

TABLE 3.18 PRODUCTION OF SILICA BY LOCATION: 1980-81 TO 1984-85
('000 tonnes)

<i>Location</i>	<i>1980-81</i>	<i>1981-82</i>	<i>1982-83</i>	<i>1983-84</i>	<i>1984-85</i>
New South Wales^a					
Marrangaroo (Lithgow)	69	66	68	83	67
Marulan	10	2	..	..	..
Anna Bay	185	186	159	124	128
Cronulla	89	92	67	64	66
Londonderry	44	50	67	72	69
Pt Kembla	60	115	93	87	..
Clarence	..	..	10	12	..
Botany	60	75	..	..	..
Kurrajong Heights	25	10	..	..	..
Total	542	596	464	442	330
Victoria^b					
Lang Lang	259	361	na	407	na
Queensland					
Brisbane	(149)	(145)	105	155	197
Bundaberg	(2)	(4)	3	2	3
Cooktown	(464)	(381)	379	539	639
Gladstone	..	..	32	32	31
Mt Isa	(32)	(28)	53	30	29
Townsville	(8)	(11)	9	9	7
Cloncurry	(14)	(14)	..	..	..
Total	669	583	581	767	906
Western Australia^c					
Lake Gngara	(28)	(40)	(29)	(27)	28
Jandakot	(100)	(71)	(94)	(124)	270
Douglas Lake	..	..	..	(141)	65
Mt Burges	..	..	..	..	34
Boyanup	..	..	..	..	7
Total	(128)	(111)	(123)	(292)	404

TABLE 3.18 (Cont.) PRODUCTION OF SILICA BY LOCATION: 1980-81 TO 1984-85

('000 tonnes)

Location	1980-81	1981-82	1982-83	1983-84	1984-85
South Australia ^d					
Normanville	(65)	(63)	(75)	(69)	(45)
Iron Knob-Whyalla	(17)	(41)	(57)	(7)	(64)
Nuriootpa	(8)	(15)	(14)	(8)	(15)
Total	(90)	(119)	(146)	(84)	(124)
Tasmania ^b	37	12	38	42	37
Total ^b	1 828	1 895	na	2 060	na

a. Production classified as Industrial Sands and Quartzite.

b. The source of these figures is ABS.

c. Production classified as 'Silica Sand'.

d. Figures for 1983 and 1984 are movements ex mine site.

.. Not applicable.

na Not available.

- Notes 1. Figures in parentheses refer to the calendar year ending 31 December of the specified fiscal year.
2. Figures do not add to totals where different sources have been used.

Sources ABS (1986b). Department of Mineral Resources, NSW (n.d.). Department of Mines and Energy, SA (n.d.a, n.d.b). Department of Mines, WA (1985). Queensland Department of Mines (1985).

Recorded production of silica sand in Western Australia was over 400 000 tonnes in 1984-85 but the bulk of production is not recorded as it is mined on private land. Silica sand is mined at Lake Gngangara (for local use), Jandakot (for export via Fremantle), and Douglas Lake (for use as flux in nickel smelting at Kambalda). Lake Gngangara and Jandakot are suburbs of Perth.

South Australia generally produces over 100 000 tonnes of silica per year. Sand is mined at Normanville and Nuriootpa. The latter is used in the Angaston cement plant while Normanville sand is trucked to Adelaide. Quartz is mined near Iron Knob and is railed to Whyalla for shipment to Bell Bay for the manufacture of silicon alloys. Quartzite is mined at Birdwood in the Adelaide Hills but details of quantities produced are not available.

Silica is mined in Tasmania at Beaconsfield and is trucked to the Bell Bay alloy plant (36 kilometres), and sands are mined at South Arm (near Hobart) for local glass manufacture. The latter production was not included in the movements database. Annual production in Tasmania is less than 50 000 tonnes.

Gypsum

Gypsum is produced in New South Wales, Victoria, Western Australia and South Australia. Western Australia and South Australia are by far the largest producers, as indicated in Table 3.19. Gypsum often occurs at the same places as salt and other sedimentary materials such as limestone, dolomite, clay and fine sand. Gypsum is used for plaster manufacture and as a soil conditioner in agricultural applications.

TABLE 3.19 PRODUCTION OF GYPSUM BY LOCATION: 1980 TO 1985
(*'000 tonnes*)

<i>Location</i>	<i>1980</i>	<i>1981</i>	<i>1982</i>	<i>1983</i>	<i>1984</i>	<i>1985</i>
New South Wales						
Bourke	na	19	17	12	21	19
Other	na	3	3	3	7	21
Total	29^a	22	20	15	28	40
Victoria						
Cowangie	2	5	18	21	(33)	na
Millewa	64	73	34	23	(17)	na
Other	203	204	183	35	(158)	na
Total	269	282	235	79	(208)	(166)^a
Western Australia						
Shark Bay- Useless Loop	207	267	338	164	348	(278)
Hines Hill	..	..	..	3	2	(4)
Lake Brown	22	25	26	23	33	(33)
Yelbini	5	17	12	15	11	(34)
Lake Hillman	14	15	12	13	18	(28)
Norseman	..	..	..	199	184	(109)
Yellowdine	33	30	36	23	37	(37)
Other	12	1	2	0	4	(22)
Total	293	355	426	440	637	(545)

TABLE 3.19 (Cont.) PRODUCTION OF GYPSUM BY LOCATION: 1980 TO 1985
('000 tonnes)

Location	1980	1981	1982	1983	1984	1985
South Australia ^b						
Lake Macdonnell	523	734	898	723	786	825
Stenhouse Bay	20	26	24	16	22	36
Lake Fowler	2	2	6	11	10	4
Morgan	12	16	4	13	23	16
Blanchetown	15	6	15	27	39	40
Cooke Plains	3	5	7	6	11	19
Kangaroo Island	188	218	184	113	116	105
Lochiel	..	..	..	..	10	6
Total	763	1 007	1 138	909	1 017	1 051
Total ^a	1 349	1 590	2 091	1 492	1 869	1 753

a. The source of these figures is ABS.

b. Figures for 1983 to 1985 are movements ex mine site.

na Not available.

.. Not applicable.

- Notes*
1. Figures in parentheses refer to the fiscal year ending 30 June of the specified calendar year.
 2. Figures do not add to totals where different sources have been used.

Sources ABS (1986b). Department of Mineral Resources, NSW (n.d.). Department of Mines and Energy, SA (n.d.a, n.d.b). Department of Mines, WA (1985). Office of Minerals and Energy, Vic (1985).

The South Australian production of approximately 1 million tonnes is mined at Lake Macdonnell, Kangaroo Island, Stenhouse Bay, Lake Fowler, Morgan, Blanchetown, Cooke Plains and Lochiel. Kangaroo Island production is shipped from Ballast Head to Adelaide, Melbourne, Sydney, Brisbane and overseas destinations. The Lake Macdonnell output is railed to Thevenard for shipping to the same destinations as well as to Port Kembla, Townsville and Devonport. The gypsum from Stenhouse Bay and Lake Fowler goes by road to Adelaide or by road to Klein Point and then by ship to Adelaide. The gypsum from Morgan is transported by road to Adelaide, while that from Blanchetown is trucked to Adelaide and Angaston. Gypsum from Cooke Plains and Lochiel is used locally and was not included in the movements database.

TABLE 3.20 PRODUCTION OF PHOSPHATE ROCK BY LOCATION: 1980-81 TO 1984-85

(tonnes)

Location	1980-81	1981-82	1982-83	1983-84	1984-85
Queensland					
Mt Isa MD	28 811	143 473	121 234	4 400	3 472
South Australia					
Angaston area	6 202	6 257	5 667	7 737	7 747
Total	35 013	149 730	126 901	12 137	11 219

MD Mining district.

Source ABS (1986b).

TABLE 3.21 PRODUCTION OF TALC BY LOCATION: 1980 TO 1985
(*'000 tonnes*)

Location	1980	1981	1982	1983	1984	1985
Western Australia						
Three Springs	91	120	73	141	142	(179)
Mt Seabrook	22	14	20	24	19	(4)
Total	113	134	93	165	161	(183)
South Australia ^a						
Mt Fitton	11	14	13	10	15	13
Gumeracha	2	3	6	1	4	3
Total	13	17	19	11	19	16
Total	126	151	112	176	180	na

a. Figures for 1983 to 1985 are movements ex mine site.
na Not available.

Note Figures in parentheses refer to the fiscal year 1984-85.

Sources Department of Mines and Energy, SA (n.d.a, n.d.b).
Department of Mines, WA (1985).

Half the Western Australian production of gypsum, in excess of half a million tonnes, is mined at Useless Loop for export. Gypsum from Norseman (Lake Cowan) is trucked to Esperance for export. Gypsum from Lake Brown (Elabbin), Yellowdine (Koolyanobbing), Lake Hillman (Kalannie) and Yelbini is railed to Perth.

The major production of gypsum in Victoria occurs at Cowangie for use in the construction industry. Smaller amounts of gypsum are also mined at Millewa (Nowingi) for this purpose. There were 15 small producers of gypsum for use in agriculture in 1983-84; shipments of these producers were not included in the database. Cowangie and Nowingi gypsum is railed to Nowra and to Geelong (Fyansford and Waurin Ponds) for cement manufacture.

Gypsum is mined in New South Wales in the Cobar, Albury and Wagga mining districts. The output from Cobar is railed to Kandos for cement manufacture.

Phosphate rock

The only remaining mining of phosphate rock is of a small deposit in South Australia which is not suitable for superphosphate manufacture due to its iron and aluminium content. Mining ceased at Phosphate Hill-Duchess (Queensland) in 1983 although shipments of stockpiled rock continued through to 1985 (by rail to Townsville).

Christmas Island, a territory of Australia, produces in the order of 1-2 million tonnes of phosphate rock each year. Australia imported about half a million tonnes of phosphate rock from Christmas Island until 1983-84. Imports have varied considerably in recent years due to a trend to import fertilisers rather than phosphate rock for fertiliser production and because of drought conditions in many parts of Australia. Other major imports of phosphate rock come from Jordan, Nauru and the United States of America.

Talc

Nearly 200 000 tonnes of talc are mined in Australia each year, mainly for use in ceramics, paints, rubber, plastics, cosmetics, insecticides and agricultural dusts. Over 90 per cent of Australian production occurs at Three Springs and Mount Seabrook in Western Australia. Mount Seabrook talc is taken by road to Fremantle for export, while Three Springs talc goes by rail to Geraldton and Fremantle for export.

Talc is also mined at Mount Fitton (North Flinders Ranges) and Gumeracha (Adelaide Hills) in South Australia. Talc from Mount Fitton is sent by road to Lyndhurst and then by rail to Adelaide and Sydney

(Granville) for processing. A small amount of talc (63 tonnes in 1983) is also mined in the Wagga mining division in New South Wales and was not included in the movements database.

CHAPTER 4 SUMMARY OF MINERAL FLOWS

This chapter summarises mineral flows in Australia by mode of transport and by State. Reliability of the data is also discussed. The summary tables presented were derived from the detailed mineral movements data in Appendix I. All movements data are on a fiscal year basis as provided by the major data sources. In some instances it was necessary to estimate mineral flows on a fiscal year basis from calendar year data.

A movement is defined as a flow between two zones, where a zone represents an ABS statistical sub-division. A summary movement is defined as a flow between an origin zone and a final destination zone. Hence a summary movement can be a single movement or a series of linked movements. For example, movements of nickel from Leinster to Leonora by road, Leonora to Kalgoorlie by rail and Kalgoorlie to Perth by rail are linked together to form the summary movement Leinster to Perth. The maximum tonnes carried by each mode in each summary movement are added together to most closely represent the total tonnes moved by each mode. Appendix II contains tables for each mineral or group of minerals showing mode of transport for the 5 years of the review. The figures for mineral movements by State are based on individual movements. Some mineral shipments are thus counted more than once when calculating total tonnes moved, as they travel by different modes or they travel by the same mode on different legs of a summary movement.

Total tonne-kilometres are calculated as the sum of tonnes moved multiplied by distance for all movements for each mode. The calculation of tonne-kilometres is not affected by whether individual or summary movements are used. Tonne-kilometres are only presented for domestic movements due to lack of suitable data on overseas destinations.

The five modes considered in the review were rail, road, pipeline, coastal shipping and overseas shipping. Coastal shipping is defined as a sea movement with both origin and destination in Australia. For

the purposes of the review Christmas Island was classified as overseas and all movements to or from Christmas Island as overseas shipping.

MINERAL MOVEMENTS BY MODE

Rail

Rail accounted for 42 per cent of total tonnes carried by all modes and 75 per cent of domestic movements in 1984-85. However, rail only accounted for 36 per cent of total domestic tonne-kilometres in 1984-85 (see Figures 4.1, 4.2 and 4.3).

Iron ore constituted 44 per cent of the total tonnes carried by rail in 1984-85 and 58 per cent of the tonne-kilometres. Shipments of iron ore from mine site to port in the Pilbara region of Western Australia were the major contributors. Black coal shipments comprised another 42 per cent of total tonnes carried by rail in 1984-85 and 35 per cent of tonne-kilometres. Table 4.1 shows the total tonnes carried by rail for each mineral and Table 4.2 the tonne-kilometres from 1980-81 to 1984-85.

Movements on the government railways, State Rail Authority (New South Wales), V/Line (Victoria), Australian National (South Australia, Northern Territory and Tasmania), Westrail (Western Australia) and Queensland Rail (Queensland), were in most cases directly obtained from statistics supplied by the individual railways. Most railways were able to supply figures for the five years of the review, however, Tasmanian figures for 1982-83 were unavailable and estimates were made for that year. Some New South Wales coal movements to Newcastle prior to 1983-84 were not available by origin. Therefore, physical origins were estimated on the basis of the 1983-84 and 1984-85 data which showed actual origins of all shipments.

Non-government railways include the Pilbara railways, the Emu Bay railway (Rosebery - Burnie) and the Iron Monarch and Iron Baron to Whyalla railways. Where information on quantities transported on these railways was unavailable, production data were used to estimate actual movements.

Although commodity classifications differed among railways and from those used in the review, in general the figures for each mineral were successfully identified. Lead, zinc and copper were the exceptions; similar production sites and destinations meant that the rail movements were not able to be split between the three minerals. Thus the figures for these minerals have been aggregated in the summary tables.

TABLE 4.1 TONNES CARRIED BY TYPE OF MINERAL: RAIL MOVEMENTS, 1980-81 TO 1984-85

('000 tonnes)

Mineral	Year				
	1980-81	1981-82	1982-83	1983-84	1984-85
Fuels					
Black coal	43 747	49 501	54 074	73 310	85 012
Brown coal	530	419	346	368	258
Crude oil	..	..	..	..	..
Total	44 277	49 920	54 420	73 678	85 270
Metallic minerals					
Iron ore	82 925	80 589	81 858	80 853	88 034
Bauxite & alumina	16 396	17 173	13 016	17 029	17 814
Nickel	3 003	3 187	2 860	1 953	2 821
Mineral sands	1 162	938	829	927	1 011
Manganese	..	..	..	..	..
Lead, zinc & copper	1 991	2 428	2 322	2 340	2 495
Uranium	1	1	..	..	..
Total	105 478	104 316	100 885	103 102	112 175
Non-metallic minerals					
Limestone	3 400	3 259	2 862	2 986	2 963
Dolomite	27	27	21	51	95
Clay	47	45	41	37	44
Salt	170	65	40	44	64
Silica	218	229	241	231	226
Gypsum	744	1 080	914	874	921
Phosphate rock	3	149	147	-	8
Talc	75	71	95	131	148
Total	4 684	4 925	4 361	4 354	4 469
Total	154 439	159 161	159 666	181 134	201 914

.. Not applicable.

- Rounded to zero.

Source BTE (1986c).

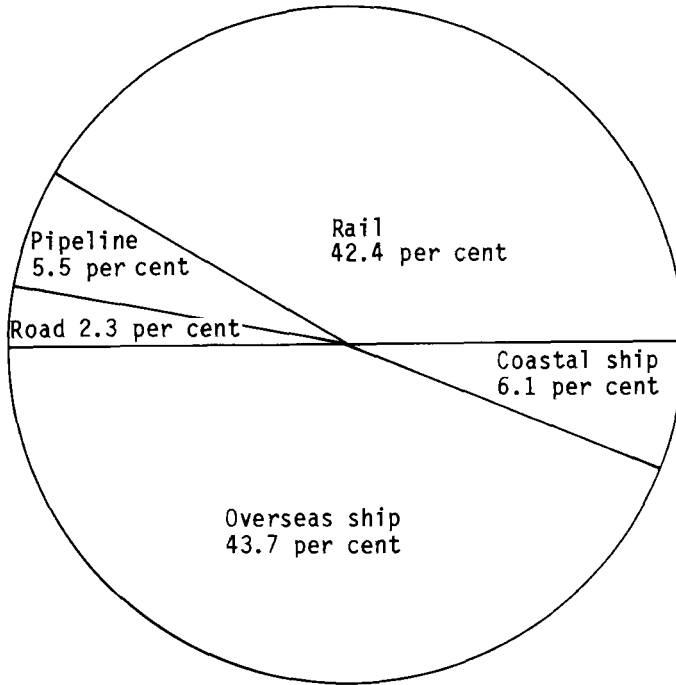
TABLE 4.2 TONNE-KILOMETRES BY TYPE OF MINERAL: RAIL MOVEMENTS,
1980-81 TO 1984-85*(million tonne-kilometres)*

<i>Mineral</i>	<i>Year</i>				
	<i>1980-81</i>	<i>1981-82</i>	<i>1982-83</i>	<i>1983-84</i>	<i>1984-85</i>
Fuels					
Black coal	9 181.7	10 271.8	10 951.5	14 296.1	17 341.7
Brown coal	83.4	65.1	65.4	80.4	62.9
Crude oil	..	..	..	..	..
Total	9 265.1	10 336.9	11 016.9	14 376.5	17 404.6
Metallic minerals					
Iron ore	27 561.3	26 950.4	27 031.9	26 217.1	28 799.6
Bauxite & alumina	650.7	656.2	578.4	701.7	734.3
Nickel	689.0	753.5	643.9	442.2	624.4
Mineral sands	191.0	164.9	142.6	159.3	195.1
Manganese	..	..	..	..	..
Lead, zinc & copper	961.9	1 114.9	1 226.5	1 404.3	1 471.7
Uranium	2.3	2.3	-	-	-
Total	30 056.2	29 642.2	29 623.3	28 924.6	31 825.1
Non-metallic minerals					
Limestone	260.2	254.2	211.3	195.7	211.6
Dolomite	18.6	18.6	14.5	12.4	21.3
Clay	8.1	7.8	7.4	6.8	8.1
Salt	50.3	26.4	14.4	13.9	17.1
Silica	17.4	18.0	18.7	17.3	17.6
Gypsum	108.2	115.3	113.1	106.7	119.3
Phosphate rock	3.2	156.5	154.4	-	8.4
Talc	20.5	19.5	19.2	28.1	31.8
Total	486.5	616.3	553.0	380.9	435.2
Total	39 807.8	40 595.4	41 193.2	43 682.0	49 664.9

.. Not applicable.

- Rounded to zero.

Source BTE (1986c).



Total 475 281 000 tonnes

Source Derived from BTE (1986c).

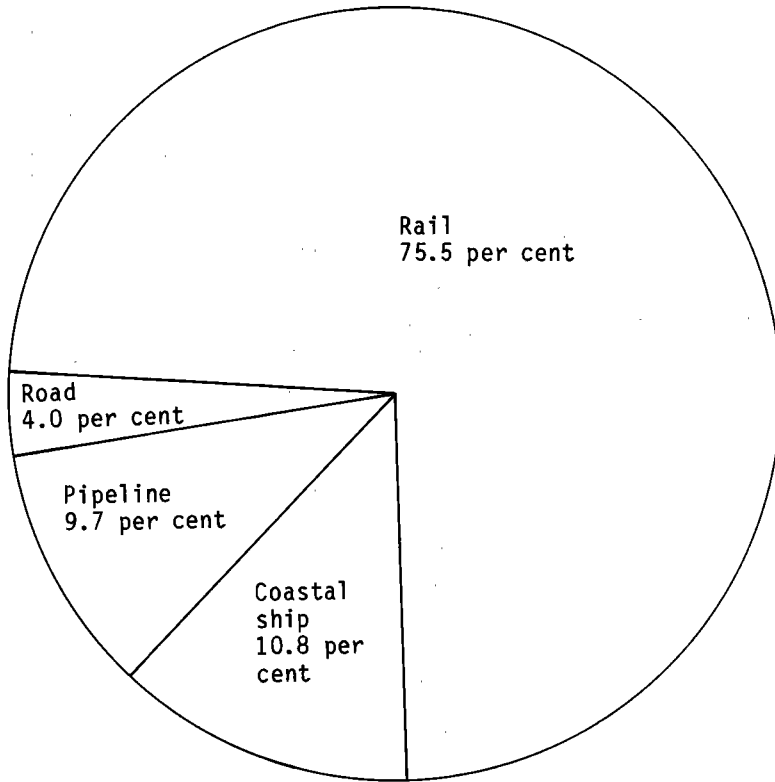
Figure 4.1 Quantity of minerals carried by mode: 1984-85

Ship

Coastal shipping

Coastal shipping accounted for 6 per cent of the total tonnes carried by all modes and 11 per cent of domestic movements. However, coastal shipping accounted for 56 per cent of the total tonne-kilometres performed domestically, reflecting the longer journey lengths for minerals transported by coastal ships (see Figures 4.1, 4.2 and 4.3).

Shipments of crude oil were the major movements by coastal ship in 1984-85. They constituted 36 per cent of the total tonnes carried and 24 per cent of the total tonne-kilometres. Iron ore contributed only 23 per cent of the total tonnes carried yet 46 per cent of the tonne-kilometres. Shipments from the Pilbara region to New South Wales steelworks were the major component in the tonne-kilometres performed. Bauxite and alumina contributed a further 23 per cent of total tonnes carried and 20 per cent of total tonne-kilometres. Thus the above



Total 267 573 000 tonnes

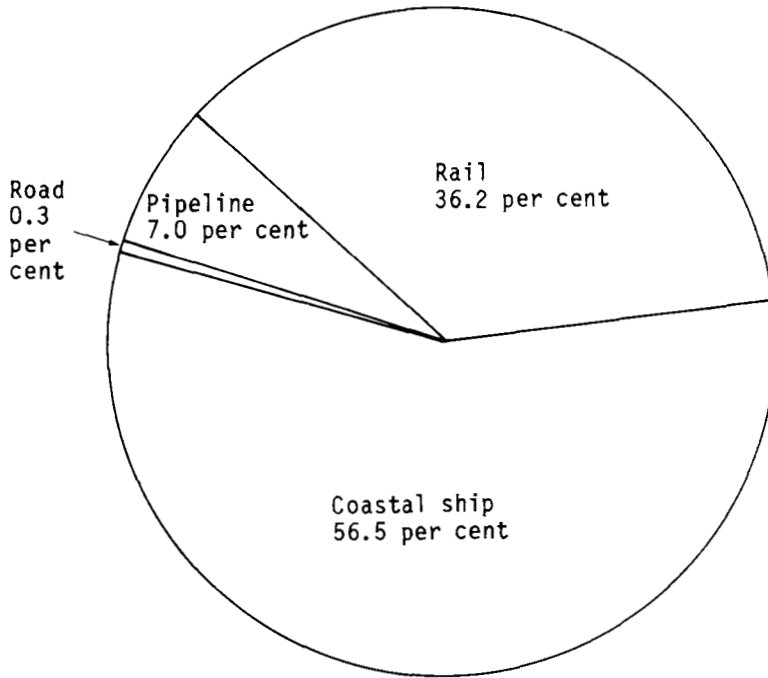
Source Derived from BTE (1986c).

**Figure 4.2 Quantity of minerals carried by mode:
domestic movements, 1984-85**

three minerals accounted for over 80 per cent of the total tonnes carried and 90 per cent of the total tonne-kilometres performed by coastal ships in 1984-85. Tables 4.3 and 4.4 respectively show the total tonnes carried and tonne-kilometres performed by coastal shipping.

Overseas shipping

Export movements by sea accounted for 42 per cent of the total mineral movements in 1984-85. Import movements accounted for less than 2 per cent. The two major contributors to exports were iron ore (89.5 million tonnes) and black coal (80.9 million tonnes). Smaller contributions were made by bauxite and alumina (13.4 million tonnes), crude oil (3.9 million tonnes) and salt (4.9 million tonnes). Imports



Total 137 250 million tonne-kilometres

Source Derived from BTE (1986c).

**Figure 4.3 Tonne-kilometres performed by mode:
domestic mineral movements, 1984-85**

were mainly crude oil (4.6 million tonnes), phosphate rock (1.6 million tonnes), and limestone (1.0 million tonnes). Tables 4.5 and 4.6 show the tonnes carried by overseas ship for each mineral for exports and imports respectively.

In most cases the tonnes carried by coastal and overseas shipping were obtained from the Port Authority Cargo Movements. Some difficulties arose due to the apparent misclassification of commodities and the allocation of some minerals to general classifications such as 'metal (non-ferrous) ores and concentrates' rather than to the specific mineral classification. Where possible the type of mineral was deduced. Where this was not possible estimates were made on the basis of production statistics.

TABLE 4.3 TONNES CARRIED BY TYPE OF MINERAL: COASTAL SHIPPING
 MOVEMENTS, 1980-81 TO 1984-85
 ('000 tonnes)

Mineral	Year				
	1980-81	1981-82	1982-83	1983-84	1984-85
Fuels					
Black coal	1 433	1 404	1 043	2 299	2 496
Brown coal	..	..	..	..	..
Crude oil	8 960	8 398	8 345	10 401	10 513
Total	10 393	9 802	9 388	12 700	13 009
Metallic minerals					
Iron ore	9 582	7 669	5 320	6 598	6 547
Bauxite & alumina	5 703	6 120	5 426	6 915	6 588
Nickel	..	..	..	..	..
Mineral sands	59	60	56	62	69
Manganese	434	322	249	298	384
Lead, zinc & copper	380	464	412	417	523
Uranium	..	..	..	..	..
Total	16 158	14 635	11 463	14 290	14 111
Non-metallic minerals					
Limestone	1 050	875	1 012	587	364
Dolomite	721	546	459	453	462
Clay	..	..	..	..	..
Salt	179	183	173	188	185
Silica	9	20	31	39	28
Gypsum	561	657	544	564	704
Phosphate rock	-	82	65	-	-
Talc	..	..	..	..	..
Total	2 520	2 363	2 284	1 831	1 743
Total	29 071	26 800	23 135	28 821	28 863

.. Not applicable.

- Rounded to zero.

Source BTE (1986c).

TABLE 4.4 TONNE-KILOMETRES BY TYPE OF MINERAL: COASTAL SHIPPING
 MOVEMENTS, 1980-81 TO 1984-85
 (million tonne-kilometres)

Mineral	Year				
	1980-81	1981-82	1982-83	1983-84	1984-85
Fuels					
Black coal	2 803.7	2 023.8	1 795.5	2 262.4	2 623.5
Brown coal	..	..	..	..	..
Crude oil	14 172.5	12 711.7	13 890.5	17 004.7	18 265.6
Total	16 976.2	14 735.5	15 686.0	19 267.1	20 889.1
Metallic minerals					
Iron ore	48 808.9	39 904.3	28 570.3	35 653.0	35 534.2
Bauxite & alumina	13 545.8	14 512.4	12 967.0	16 345.7	15 868.4
Nickel	..	..	..	..	..
Mineral sands	179.8	182.8	170.6	188.9	210.2
Manganese	1 951.4	1 463.4	1 135.7	1 362.7	1 785.1
Lead, zinc & copper	656.6	774.8	572.6	558.8	760.5
Uranium	..	..	..	..	..
Total	65 142.5	56 837.7	43 416.2	54 109.1	54 158.4
Non-metallic minerals					
Limestone	17.3	16.0	18.9	11.2	7.0
Dolomite	1 234.5	838.6	697.3	689.7	681.7
Clay	..	..	..	..	..
Salt	236.6	252.9	238.8	267.5	301.6
Silica	12.3	27.4	42.5	53.4	38.4
Gypsum	1 020.0	1 295.7	1 153.6	1 096.6	1 489.7
Phosphate rock	-	-	-	-	-
Talc	..	..	..	..	..
Total	2 520.7	2 430.6	2 151.1	2 118.4	2 518.4
Total	84 639.4	74 003.8	61 253.3	75 494.6	77 565.9

.. Not applicable.

- Rounded to zero.

Source BTE (1986c).

TABLE 4.5 TONNES CARRIED BY TYPE OF MINERAL: EXPORTS BY SHIP, 1980-81 TO 1984-85

('000 tonnes)

Mineral	Year				
	1980-81	1981-82	1982-83	1983-84	1984-85
Fuels					
Black coal	46 870	46 800	53 224	66 254	80 947
Brown coal	71	53	33	98	96
Crude oil	-	-	-	1 164	3 902
Total	46 941	46 853	53 257	67 516	84 945
Metallic minerals					
Iron ore	79 397	78 411	72 062	84 400	89 548
Bauxite & alumina	12 570	11 969	10 399	12 092	13 407
Nickel	26	61	47	54	55
Mineral sands	1 721	1 524	1 462	1 777	1 998
Manganese	1 020	1 020	828	1 309	1 440
Lead, zinc & copper	820	958	1 239	1 206	1 240
Uranium	2	5	4	4	3
Total	95 556	93 948	86 041	100 842	107 691
Non-metallic minerals					
Limestone	..	..	..	..	..
Dolomite	..	..	..	..	..
Clay	-	-	-	12	14
Salt	4 198	3 684	4 163	4 673	4 944
Silica	567	489	525	680	832
Gypsum	511	827	636	885	600
Phosphate rock ^a	1 417	1 680	1 265	1 162	1 210
Talc	92	79	100	158	124
Total	6 785	6 759	6 689	7 570	7 724
Total	149 282	147 560	145 987	175 928	200 360

a. Exports of phosphate rock are from Christmas Island.

.. Not applicable.

- Rounded to zero.

Source BTE (1986c).

TABLE 4.6 TONNES CARRIED BY TYPE OF MINERAL: IMPORTS BY SHIP, 1980-81 TO 1984-85

('000 tonnes)

Mineral	Year				
	1980-81	1981-82	1982-83	1983-84	1984-85
Fuels					
Crude oil	8 944	8 785	7 025	5 005	4 633
Metallic minerals					
Iron ore	27	46	34	30	40
Lead, zinc & copper	44	41	24	39	41
Total	71	87	58	69	81
Non-metallic minerals					
Limestone	1 242	1 106	837	898	1 028
Clay	36	24	20	19	2
Phosphate rock ^a	2 115	2 129	1 983	1 628	1 606
Total	3 393	3 259	2 840	2 545	2 636
Total	12 408	12 131	9 923	7 619	7 350

a. Imports of Phosphate Rock are from Christmas Island and overseas.

Source BTE (1986c).

Road

Road movements accounted for approximately 2 per cent (10.8 million tonnes) of total mineral movements and 4 per cent of domestic movements in 1984-85. In terms of tonne-kilometres, road accounted for 0.3 per cent of the total in 1984-85. Black coal represented 83 per cent of tonnes carried and 58 per cent of tonne-kilometres attributable to road transport in 1984-85. Other significant minerals were lead, zinc and copper (0.5 million tonnes and 40 million tonne-kilometres) and bauxite and alumina (0.4 million tonnes and 17 million tonne-kilometres). Only 0.3 million tonnes of gypsum was carried in 1984-85 although over longer distances than most other minerals with 48 million tonne-kilometres being recorded. Tables 4.7 and 4.8 respectively show the tonnes and tonne-kilometres for minerals carried by road.

Published information on road movements of minerals is generally not available. Estimates, mostly based on production data, were made for movements identified from other sources (see Chapter 2). Statistics provided by the South Australian Department of Mines and Energy for the calendar years 1983 to 1985 include movements by road ex mine sites.

Many short-haul movements by road from mine site to railhead or mine site to processing plant were not included in the movements data base due to the lack of data.

Pipeline

In 1984-85 mineral movements by pipeline accounted for 26 million tonnes or 6 per cent of total tonnes carried and 10 per cent of domestic movements. Pipeline transport accounted for 7 per cent of total tonne-kilometres in 1984-85. The main movements were crude oil (23.1 million tonnes and 9325 million tonne-kilometres) from the Gippsland Shelf and Moomba and Jackson in the Cooper Basin. Tables 4.9 and 4.10 respectively show the total tonnes and tonne-kilometres attributable to pipeline transport.

Pipeline movements were generally estimated from production. The exception was the movement from Blina-Sundown to the North-western Highway in the North-east of Western Australia (and then to Broome by road) which was estimated from the PACM data ex Broome.

MINERAL MOVEMENTS BY STATE

The discussion of mineral movements in this section is based on the statistics presented in Tables 4.11 to 4.16. The four types of movement are export, import, interstate and intrastate. Here intrastate movements are defined as individual movements with the origin and destination in the same State. Thus, they may include shipments which will, in a later movement, be exported or sent interstate. Hence the total movements in Tables 4.11 to 4.16 will differ from corresponding totals in Appendix II due to double counting. This section will, however, enable a comparison of the transport task undertaken within each State and the Northern Territory. There was no production or transport of the minerals included in the review within the Australian Capital Territory.

Western Australia

Western Australia is the largest source of mineral movements in Australia. Approximately 209 million tonnes of minerals included in the review either originated in or were destined for Western Australia

TABLE 4.7 TONNES CARRIED BY TYPE OF MINERAL: ROAD MOVEMENTS, 1980-81 TO 1984-85

('000 tonnes)

Mineral	Year				
	1980-81	1981-82	1982-83	1983-84	1984-85
Fuels					
Black coal	8 278	6 986	5 903	6 263	8 968
Brown coal	..	..	..	..	..
Crude oil	14	14	12	36	41
Total	8 292	7 000	5 915	6 299	9 009
Metallic minerals					
Iron ore	..	..	..	..	..
Bauxite & alumina	188	166	125	357	400
Nickel	179	166	133	87	71
Mineral sands	..	..	..	..	..
Manganese	..	..	..	..	..
Lead, zinc & copper	197	418	511	465	507
Uranium	3	4	4	4	3
Total	567	754	773	913	981
Non-metallic minerals					
Limestone	71	88	101	100	98
Dolomite	..	..	..	..	..
Clay	39	34	39	51	21
Salt	191	161	139	150	137
Silica	340	328	322	289	266
Gypsum	50	53	94	361	260
Phosphate rock	6	6	6	8	8
Talc	18	17	22	22	4
Total	715	687	723	981	794
Total	9 574	8 441	7 411	8 193	10 784

.. Not applicable.

Source BTE (1986c).

TABLE 4.8 TONNE-KILOMETRES BY TYPE OF MINERAL: ROAD MOVEMENTS, 1980-81 TO 1984-85

(million tonne-kilometres)

<i>Mineral</i>	<i>Year</i>				
	<i>1980-81</i>	<i>1981-82</i>	<i>1982-83</i>	<i>1983-84</i>	<i>1984-85</i>
<i>Fuels</i>					
Black coal	295.7	258.1	204.0	194.6	275.9
Brown coal	..	..	..	..	..
Crude oil	5.7	5.7	4.9	4.2	3.3
Total	301.4	263.8	208.9	198.8	279.2
<i>Metallic minerals</i>					
Iron ore	..	..	..	..	..
Bauxite & alumina	7.9	7.0	5.3	15.0	16.8
Nickel	21.6	18.5	16.9	15.0	13.3
Mineral sands	..	..	..	..	..
Manganese	..	..	..	..	..
Lead, zinc & copper	141.3	108.0	99.9	110.7	39.9
Uranium	0.6	0.8	0.9	0.9	0.7
Total	171.4	134.3	123.0	141.6	70.7
<i>Non-metallic minerals</i>					
Limestone	6.6	12.3	16.7	16.5	18.6
Dolomite	..	..	..	..	..
Clay	15.4	21.4	35.3	29.6	7.2
Salt	45.7	36.9	34.5	40.8	27.7
Silica	26.3	25.6	25.6	26.0	22.5
Gypsum	9.9	10.5	16.8	70.0	48.4
Phosphate rock	0.5	0.5	0.5	0.7	0.7
Talc	15.3	14.5	18.7	18.7	3.4
Total	119.7	121.7	148.1	202.3	128.5
Total	592.5	519.8	480.0	542.7	478.4

.. Not applicable.

Source BTE (1986c).

TABLE 4.9 TONNES CARRIED BY TYPE OF MINERAL: PIPELINE MOVEMENTS,
1980-81 TO 1984-85
('000 tonnes)

<i>Mineral</i>	<i>Year</i>				
	<i>1980-81</i>	<i>1981-82</i>	<i>1982-83</i>	<i>1983-84</i>	<i>1984-85</i>
Fuels					
Crude oil	16 380	17 084	16 347	20 028	23 062
Metallic minerals					
Iron ore	2 175	2 021	2 294	2 103	2 250
Non-metallic minerals					
Limestone	275	108	529	647	700
Total	18 830	19 213	19 170	22 778	26 012

Source BTE (1986c).

TABLE 4.10 TONNE-KILOMETRES BY TYPE OF MINERAL: PIPELINE MOVEMENTS
1980-81 TO 1984-85
(million tonne-kilometres)

<i>Mineral</i>	<i>Year</i>				
	<i>1980-81</i>	<i>1981-82</i>	<i>1982-83</i>	<i>1983-84</i>	<i>1984-85</i>
Fuels					
Crude oil	6 155.7	6 482.7	6 244.8	7 731.1	9 325.0
Metallic minerals					
Iron ore	184.9	171.8	195.0	178.8	191.3
Non-metallic minerals					
Limestone	9.6	3.8	18.5	22.6	24.5
Total	6 350.2	6 658.3	6 458.3	7 932.5	9 540.8

Source BTE (1986c).

in 1984-85. This represents 43 per cent of the total tonnes carried. Nearly half of the movements of minerals attributable to Western Australia were exports (99 million tonnes), mainly of iron ore, bauxite and alumina, and salt. Only 4 per cent or 7.6 million tonnes were shipped to interstate destinations (see Table 4.13); mostly iron ore to New South Wales steelworks.

Metallic minerals accounted for 95 per cent of total tonnes moved in Western Australia in 1984-85. Transport of non-metallic minerals contributed 3 per cent and fuel minerals 2 per cent of the total.

Imports of minerals to Western Australia from overseas and interstate amounted to 3.1 million tonnes in 1984-85. These were mainly shipments of crude oil from Victoria and overseas and imports of phosphate rock (see Appendix I).

Queensland

Queensland is the second largest contributor of mineral movements in Australia with 128 million tonnes being shipped within the State in 1984-85. This represents 26 per cent of the total tonnes carried in Australia. Exports accounted for 50.3 million tonnes or 39 per cent of the total tonnes carried in Queensland while interstate movements contributed 3 per cent (4.1 million tonnes) and intrastate movements 57 per cent (73.0 million tonnes). Imports were an insignificant proportion of the total transport task.

Fuel minerals, mainly black coal, dominate the minerals transport task in Queensland, representing almost 80 per cent of the total in 1984-85. Transport of metallic minerals, mainly bauxite and alumina, represented 19 per cent (24.0 million tonnes) and non-metallic minerals, mainly limestone and silica, 2 per cent (2.1 million tonnes).

New South Wales

New South Wales mineral movements constituted 20 per cent of national mineral movements in 1984-85. Exports, mainly black coal, accounted for 38 per cent of New South Wales movements. New South Wales is the largest importer of domestic and overseas minerals. Imports from interstate and overseas accounted for 15.4 million tonnes or 16 per cent of New South Wales movements in 1984-85. The second largest importer was South Australia with only 4.1 million tonnes. The major mineral flows into New South Wales are iron ore from Western Australia, crude oil from Victoria and overseas, bauxite and alumina from Queensland and dolomite from South Australia (see Appendix I).

Victoria

Movements of minerals in Victoria represented 9 per cent of total Australian movements in 1984-85. Intrastate movements accounted for 67 per cent of Victorian movements, and were mostly shipments of crude oil from the Gippsland shelf to Victorian refineries and Westernport Bay. Shipments interstate and overseas which make up another 30 per cent of Victorian movements (12.6 million tonnes) are also mostly crude oil. Alumina from Western Australia to the smelter at Point Henry (Geelong), gypsum from South Australia and phosphate from overseas make up the major imports to Victoria, which in 1984-85 were about 1.3 million tonnes.

South Australia

Movements of minerals in South Australia represented 3 per cent of total Australian movements in 1984-85. Intrastate movements accounted for 50 per cent of South Australian movements and were mainly black coal from Leigh Creek to Port Augusta, crude oil from Moomba to Port Bonython, iron ore from the Middleback Ranges to Whyalla and gypsum from Lake Macdonnell to Thevenard.

Interstate movements, representing 33 per cent of South Australian movements in 1984-85, were mainly black coal imports from New South Wales and shipments of crude oil, dolomite and gypsum to various States. Imports of crude oil and exports of gypsum were the major overseas movements.

Tasmania

Tasmanian mineral movements represented less than 2 per cent of the national total in 1984-85. The major mineral movement in Tasmania comprises iron ore shipments from Savage River to Port Latta and then overseas (2.3 million tonnes in each link; see Appendix I). This summary movement represented 64 per cent of the Tasmanian mineral transport task. Other major movements in 1984-85 were imports of alumina from Western Australia, zinc (with smaller amounts of gypsum, silica, salt and dolomite) from South Australia and 0.3 million tonnes of manganese from the Northern Territory.

Northern Territory

Northern Territory mineral movements represented 1 per cent of the national total in 1984-85. Movements of manganese from Groote Eylandt to overseas and bauxite and alumina from Gove to overseas accounted for 5.3 million tonnes or 91 per cent of Northern Territory movements in 1984-85.

TABLE 4.11 TONNES CARRIED BY STATE OF ORIGIN AND DESTINATION: MINERALS INCLUDED IN THE REVIEW, 1984-85
('000 tonnes)

<i>Origin</i>	<i>Destination</i>								<i>Total</i>
	<i>NSW</i>	<i>Vic</i>	<i>Qld</i>	<i>SA</i>	<i>WA</i>	<i>Tas</i>	<i>NT</i>	<i>Overseas</i>	
NSW	43 632	9	-	1 891	-	168	30	37 445	83 175
Vic	4 323	28 552	3 147	38	1 128	-	-	4 012	41 200
Qld	506	-	72 954	38	-	41	-	50 280	123 819
SA	1 259	378	297	7 064	173	266	-	619	10 056
WA	6 592	342	-	378	98 766	331	-	99 093	205 502
Tas	15	-	38	-	-	3 484	-	2 446	5 983
NT	85	10	6	-	-	289	3	5 265	5 658
Overseas	2 664	552	539	1 736	1 773	2	84	1 200	8 550
Total	59 076	29 843	76 981	11 145	101 840	4 581	117	200 360	483 943

- Rounded to zero.

Source BTE (1986c).

TABLE 4.12 TONNE KILOMETRES BY STATE OF ORIGIN AND DESTINATION: MINERALS INCLUDED IN THE REVIEW, 1984-85
(million tonne-kilometres)

<i>Origin</i>	<i>Destination</i>								<i>Total</i>
	<i>NSW</i>	<i>Vic</i>	<i>Qld</i>	<i>SA</i>	<i>WA</i>	<i>Tas</i>	<i>NT</i>	<i>Overseas</i>	
NSW	4 663	4	-	2 613	-	201	121	na	7 602
Vic	4 174	7 847	5 665	23	3 430	-	-	na	21 139
Qld	622	-	28 233	155	-	122	-	na	29 132
SA	2 603	460	908	1 418	439	401	-	na	6 229
WA	36 781	1 007	-	1 445	30 582	1 025	-	na	70 840
Tas	17	-	101	-	-	422	-	na	540
NT	336	49	12	-	-	1 400	1	na	1 798
Overseas	na	na	na	na	na	na	na	na	na
Total	49 196	9 368	34 918	5 654	34 451	3 571	121	na	137 280

- Rounded to zero.

na Not available.

Source BTE (1986c).

TABLE 4.13 QUANTITY OF MINERALS MOVED BY STATE AND TYPE OF MOVEMENT:
ALL MINERALS INCLUDED IN THE REVIEW, 1984-85
('000 tonnes)

State	Type of movement					
	Exports	Imports	Intrastate	Interstate		Total
				In	Out	
NSW	37 445	2 664	43 632	12 780	2 098	98 619
Vic	4 012	552	28 552	739	8 636	42 491
Qld	50 280	539	72 954	3 488	585	127 846
SA	619	1 736	7 064	2 345	2 373	14 137
WA	99 093	1 773	98 766	1 301	7 643	208 576
Tas	2 446	2	3 484	1 095	53	7 080
NT	5 265	84	3	30	390	5 772
Total	199 160	7 350	254 455	21 778	21 778	504 521

Source BTE (1986c).

TABLE 4.14 QUANTITY OF MINERALS MOVED BY STATE AND TYPE OF MOVEMENT:
FUEL MINERALS, 1984-85
('000 tonnes)

State	Type of movement					
	Exports	Imports	Intrastate	Interstate		Total
				In	Out	
NSW	37 250	1 739	40 077	4 909	1 215	85 190
Vic	3 998	99	28 235	45	8 632	41 009
Qld	43 697	499	54 200	3 270	14	101 680
SA	..	1 304	2 850	1 572	681	6 407
WA	..	992	1 268	1 301	614	4 175
Tas	..	..	307	29	..	336
NT	..	..	..	30	..	30
Total	84 945	4 633	126 937	11 156	11 156	238 827

.. Not applicable.

Source BTE (1986c).

TABLE 4.15 QUANTITY OF MINERALS MOVED BY STATE AND TYPE OF MOVEMENT: METALLIC MINERALS, 1984-85
('000 tonnes)

State	Type of movement					
	Exports	Imports	Intrastate	Interstate		Total
				In	Out	
NSW	195	23	868	7 172	874	9 132
Vic	..	..	..	352	..	352
Qld	5 883	40	17 612	44	479	24 058
SA	424	18	2 026	773	453	3 694
WA	93 478	..	97 073	..	7 029	197 580
Tas	2 446	..	3 128	937	53	6 564
NT	5 265	..	3	..	390	5 658
Total	107 691	81	120 710	9 278	9 278	247 038

.. Not applicable.

Source BTE (1986c).

TABLE 4.16 QUANTITY OF MINERALS MOVED BY STATE AND TYPE OF MOVEMENT: NON-METALLIC MINERALS, 1984-85
('000 tonnes)

State	Type of movement					
	Exports	Imports	Intrastate	Interstate		Total
				In	Out	
NSW	..	902	2 687	699	9	4 297
Vic	14	453	317	342	4	1 130
Qld	700	..	1 142	174	92	2 108
SA	195	414	2 188	..	1 239	4 036
WA	5 615	781	425	..	..	6 821
Tas	..	2	49	129	..	180
NT	..	84	..	..	..	84
Total	6 524	2 636	6 808	1 344	1 344	18 656

.. Not applicable.

Source BTE (1986c).

APPENDIX I DETAILED MINERAL MOVEMENTS

This appendix shows detailed flows between zones for each mineral. A zone generally represents an ABS statistical sub-division, except for capital cities where the zone represents the statistical division. The sub-divisions and divisions are as defined for the 1981 Census of Population and Housing and were obtained from a map produced by NATMAP in conjunction with the ABS.

A zone number is represented by four digits. The first digit is the State code and the last three are the statistical sub-division number. A capital city is represented by the State code followed by three zeros. The State codes are:

<i>Code</i>	<i>State</i>
2	New South Wales
3	Victoria
4	Queensland
5	South Australia
6	Western Australia
7	Tasmania
8	Northern Territory.

Thus the zone number 7013 represents statistical sub-division number 13 in Tasmania and 7000 represents the statistical division incorporating Hobart. Overseas origins and destinations are represented by the zone number 9000. Christmas Island is represented by the zone number 9001.

Land distances were generally estimated from road maps. Crude oil pipeline distances were obtained from the BMR. Sea distances were generally obtained from a matrix of port to port distances supplied by DoT. Those not included in the matrix were estimated. A conversion factor of 1.852 kilometres per nautical mile was used to convert the distances to kilometres.

Each movement was allocated a movement number which enables movements to be linked to the previous and subsequent movements where

applicable. The previous and next connections were used mainly in the calculation of summary statistics.

Generally, intrazonal movements were not included in the database either because of insufficient data or because the distance hauled was considered insignificant. Those intrazonal movements that were included are shown in Table I.1.

TABLE I.1 INTRAZONAL MOVEMENTS INCLUDED IN THE DATABASE

<i>Mineral</i>	<i>Origin-destination</i>	<i>Distance (km)</i>	<i>Mode</i>	<i>Zone</i>
Black coal	Wallsend-Newcastle	22	Rail	2116
	Wallsend-Newcastle	22	Road	2116
	Bulli-Port Kembla	17	Rail	2170
	Bulli-Port Kembla	17	Road	2170
	Newlands-Abbot Point	170	Rail	4020
	Collinsville-Abott Point	102	Rail	4020
	Collinsville-Bowen	98	Rail	4020
Crude oil	Blina-Sundown-Northern Highway	29	Pipe	6014
	Northern Highway-Broome	34	Road	6014
Nickel	Nepean-Kambalda	50	Road	6028
	Leinster-Leonora	188	Road	6070
Lead and zinc	Teutonic Bore-Leonora	60	Road	6070
	Puttapa-Copley	20	Road	5129
Copper	Teutonic Bore-Leonora	60	Road	6070
	Mt Chalmers-Mt Morgan	71	Rail	4263
Limestone	Coffin Bay-Proper Bay	60	Rail	5052
	Buchan-Nowa Nowa	32	Road	3182
Gypsum	Lake Fowler-Klein Point	25	Road	5128

Source BTE (1986c).

TABLE I.2 BLACK COAL TRANSPORT BY ORIGIN-DESTINATION AND MODE: 1980-81 TO 1984-85

Move no.	Origin		Destination		Distance (km)	Prev. Mode	Next move	1980-81	1981-82	1982-83	1983-84	1984-85	
	Zone	Name	Zone	Name									
1	4260	Ipswich	4000	Brisbane	59	Rail	..	3	0	0	412	858	1 350
2	4260	Perry's Nob	4000	Brisbane	58	Rail	..	..	14	7	7	7	7
3	4000	Brisbane	9000	Overseas	na	Seao	1	..	388	469	732	838	1 403
4	4000	Brisbane	4225	Gladstone	461	Seac	1	19	0	42	0	0	0
5	4011	Laleham	4225	Gladstone	337	Rail	..	19	1 645	1 673	1 626	1 532	1 789
6	4215	Boonal	4225	Gladstone	289	Rail	..	19	0	118	187	183	260
7	4215	Kinrola	4225	Gladstone	315	Rail	..	19	3 062	2 715	2 479	2 995	2 980
8	4215	Koorilgah	4225	Gladstone	311	Rail	..	19	339	449	334	501	651
9	4215	Curragh	4225	Gladstone	312	Rail	..	19	0	0	0	2 106	3 491
10	4273	Gregory	4225	Gladstone	368	Rail	..	19	1 515	2 348	2 027	1 993	2 904
11	4273	Oaky Creek	4225	Gladstone	384	Rail	..	19	0	0	356	897	964
12	4273	German Creek	4225	Gladstone	403	Rail	..	19	0	404	2 080	1 277	0
13	4013	Blair Athol	4225	Gladstone	486	Rail	..	19	19	27	65	21	0
14	4008	Moura	4225	Gladstone	177	Rail	..	19	2 316	2 476	2 014	2 308	1 963
15	4215	Boorgoon	4225	Gladstone	305	Rail	..	19	2 015	1 922	1 814	1 119	904
16	4008	Callide	4225	Gladstone	149	Rail	..	19	2 004	1 816	2 051	1 675	1 206
17	4008	Boundary Hill	4225	Gladstone	112	Rail	..	19	0	0	679	1 620	1 364
18	2116	Newcastle	4225	Gladstone	1 198	Seac	53	19	42	0	0	0	0
19	4225	Gladstone	9000	Overseas	na	Seao	7	..	8 135	9 106	10 824	12 169	12 891
20	4225	Gladstone	5124	Whyalla	3 369	Seac	7	..	306	56	69	0	0
21	4273	Oaky Creek	4287	Dalrymple Bay	292	Rail	..	32	0	0	0	1 311	1 805
22	4013	Riverside	4287	Dalrymple Bay	201	Rail	..	32	0	0	0	1 674	3 149

TABLE I.2 (Cont.) BLACK COAL TRANSPORT BY ORIGIN-DESTINATION AND MODE: 1980-81 TO 1984-85

Move no.	Origin		Destination		Distance (km)	Prev. Mode	Next move	1980-81	1981-82	1982-83	1983-84	1984-85	
	Zone	Name	Zone	Name				('000 tonnes)					
23	4013	Blair Athol	4287	Dalrymple Bay	280	Rail	..	32	0	0	0	633	3 619
24	4273	German Creek	4287	Dalrymple Bay	276	Rail	..	32	0	0	0	1 254	2 991
25	4013	Blair Athol	4283	Parkhurst	394	Rail	..	..	44	45	44	24	0
26	4013	Blair Athol	4283	Parkhurst	521	Rail	..	..	0	0	0	20	39
27	4013	Goonyella	4287	Hay Point	197	Rail	..	32	4 234	4 364	4 387	4 715	3 976
28	4013	Peak Downs	4287	Hay Point	190	Rail	..	32	4 255	3 567	3 721	4 063	4 344
29	4193	Saraji	4287	Hay Point	212	Rail	..	32	3 709	2 880	3 947	4 016	4 551
30	4193	Norwich Park	4287	Hay Point	256	Rail	..	32	3 620	4 281	2 905	2 809	2 812
31	4013	Riverside	4287	Hay Point	204	Rail	..	32	0	0	0	174	0
32	4287	Hay Point	9000	Overseas	na	Seao	27	..	15 076	15 173	14 168	20 000	26 814
33	4020	Newlands	4020	Abbott Point	170	Rail	..	35	0	0	0	487	3 658
34	4020	Collinsville	4020	Abbott Point	102	Rail	..	35	0	0	0	200	743
35	4020	Abbott Point	9000	Overseas	na	Seao	34	..	0	0	0	481	2 589
36	4020	Collinsville	4212	Cobarra	293	Rail	..	..	0	149	264	191	209
37	4020	Collinsville	4262	Mica Creek	1 217	Rail	..	..	401	446	482	338	398
38	4020	Collinsville	4292	Stuart	259	Rail	..	..	48	60	53	53	60
39	4020	Collinsville	4020	Bowen	98	Rail	..	40	376	199	63	67	64
40	4020	Bowen	9000	Overseas	na	Seao	39	..	308	172	0	0	0
41	4260	Perry's Nob	4275	A.P.M. Petrie	90	Rail	..	..	53	61	68	72	73
42	4255	Burgowan	4195	Woongarra	83	Rail	..	..	10	5	9	9	10
43	2030	Campbelltown	2116	Newcastle	227	Rail	..	58	42	7	0	0	0
44	2170	Port Kembla	2116	Newcastle	193	Seac	..	..	79	294	80	42	185

TABLE I.2 (Cont.) BLACK COAL TRANSPORT BY ORIGIN-DESTINATION AND MODE: 1980-81 TO 1984-85

Move no.	Origin		Destination		Distance (km)	Prev. Mode	Next move	1980-81	1981-82	1982-83	1983-84	1984-85	
	Zone	Name	Zone	Name				('000 tonnes)					
45	2170	Port Kembla	2116	Newcastle	260	Road	..	58	0	71	63	42	48
46	2170	Wollongong	2116	Newcastle	240	Rail	..	58	440	370	256	259	212
47	4225	Gladstone	2116	Newcastle	1 198	Seac	7	58	0	44	0	0	14
48	2068	Gunnedah	2116	Newcastle	320	Rail	..	58	115	347	259	680	666
49	2090	Awaba	2116	Newcastle	34	Rail	..	58	0	0	86	0	0
50	2095	Mount Victoria	2116	Newcastle	302	Rail	..	58	468	145	0	0	0
51	2099	Maitland	2116	Newcastle	38	Rail	..	58	1 587	1 558	1 260	1 639	1 744
52	2106	Gulgong-Ulan	2116	Newcastle	276	Rail	..	58	457	1 386	1 035	2 022	3 352
53	2111	Muswellbrook	2116	Newcastle	127	Rail	..	58	1 246	3 777	2 819	7 648	7 001
54	2138	Singleton	2116	Newcastle	83	Rail	..	58	902	2 734	2 041	5 042	5 559
55	2116	Wallsend	2116	Newcastle	22	Rail	..	58	664	2 013	3 668	4 089	3 951
56	2116	Wallsend	2116	Newcastle	22	Road	..	58	2 349	1 796	1 567	1 409	2 337
57	2138	Singleton	2116	Newcastle	86	Road	..	58	150	6	5	17	590
58	2116	Newcastle	9000	Overseas	na	Seac	..	..	13 825	12 894	17 154	20 701	24 666
59	2116	Newcastle	4306	Bundaburg	1 107	Seac	53	..	0	0	49	0	0
60	2116	Hexham	2000	Port Jackson	113	Seac	..	..	0	0	0	161	0
61	2116	Newcastle	2000	Port Jackson	113	Seac	53	..	36	47	46	31	40
62	2116	Newcastle	5124	Whyalla	2 200	Seac	53	..	0	20	53	0	5
63	2116	Newcastle	7027	Launceston	1 035	Seac	53	..	10	4	11	12	15
64	2169	Picton	2170	Port Kembla	145	Rail	..	77	0	25	307	704	796
65	2168	Exeter	2170	Port Kembla	90	Rail	..	77	0	0	0	30	0

TABLE I.2 (Cont.) BLACK COAL TRANSPORT BY ORIGIN-DESTINATION AND MODE: 1980-81 TO 1984-85

Move no.	Origin		Destination		Distance (km)	Prev. Mode	Next move	1980-81	1981-82	1982-83	1983-84	1984-85	
	Zone	Name	Zone	Name				('000 tonnes)					
66	4225	Gladstone	2170	Port Kembla	1 380	Seac	7	77	0	0	52	0	0
67	2000	Sydney	2170	Port Kembla	86	Rail	..	77	0	0	0	9	0
68	2073	Richmond	2170	Port Kembla	152	Rail	..	77	123	0	0	0	365
69	2106	Gulgong-Ulan	2170	Port Kembla	420	Rail	..	77	103	0	38	120	160
70	2111	Muswellbrook	2170	Port Kembla	375	Rail	..	77	0	0	0	37	471
71	2095	Wallerawang	2170	Port Kembla	257	Rail	..	77	242	541	897	1 176	865
72	2030	Campbelltown	2170	Port Kembla	140	Rail	..	77	0	301	99	116	49
73	2170	Bulli	2170	Port Kembla	17	Rail	..	77	2 637	1 699	2 686	2 353	1 871
74	2170	Bulli	2170	Port Kembla	17	Road	..	77	3 255	3 182	2 746	3 142	4 468
75	2169	Picton	2170	Port Kembla	56	Road	..	77	2 300	1 688	1 387	1 619	1 525
76	2095	Lithgow	2170	Port Kembla	210	Road	..	77	224	243	135	34	0
77	2170	Port Kembla	9000	Overseas	na	Seac	..	..	6 554	6 310	6 351	8 358	9 471
78	2170	Port Kembla	5094	Port Pirie	2 013	Seac	..	..	50	0	73	36	35
79	2170	Port Kembla	5124	Whyalla	2 015	Seac	..	..	785	817	533	1 025	1 105
80	2170	Port Kembla	7027	Launceston	850	Seac	..	..	0	0	0	0	5
81	2170	Port Kembla	6000	Fremantle	3 898	Seac	..	..	0	0	16	0	0
82	2170	Port Kembla	8035	Groote Eylandt	4 019	Seac	..	..	0	0	0	0	30
83	2170	Coalcliff	2000	Sydney	61	Rail	..	91	15	33	0	0	20
84	2111	Muswellbrook	2000	Sydney	287	Rail	..	91	0	0	0	0	87
85	2169	Picton	2000	Sydney	80	Rail	..	91	0	176	315	0	96
86	2106	Ulan	2000	Sydney	448	Rail	..	91	0	0	0	55	0
87	2030	Campbelltown	2000	Sydney	52	Rail	..	91	789	246	306	438	347

TABLE 1.2 (Cont.) BLACK COAL TRANSPORT BY ORIGIN-DESTINATION AND MODE: 1980-81 TO 1984-85

Move no.	Origin		Destination		Distance (km)	Mode	Prev. move	Next move	1980-81	1981-82	1982-83	1983-84	1984-85
	Zone	Name	Zone	Name					('000 tonnes)				
88	2095	Mount Victoria	2000	Sydney	155	Rail	..	91	1 649	1 771	3 493	3 228	2 191
89	2073	Richmond	2000	Sydney	66	Rail	..	91	0	0	0	0	39
90	2172	Catherine Hill Bay	2000	Port Jackson	83	Seac	..	..	125	80	61	992	1 042
91	2000	Port Jackson	9000	Overseas	na	Seao	..	..	2 584	2 676	3 995	3 707	3 113
92	2000	Port Jackson	5094	Port Pirie	2 089	Seac	89	..	0	0	0	0	11
93	2000	Port Jackson	7005	Burnie	965	Seac	89	..	0	0	0	0	9
94	7013	Duncan	7010	Devonport	211	Rail	..	..	0	0	0	0	17
95	7013	Duncan	7023	Railton	186	Rail	..	..	60	60	63	58	73
96	7013	Duncan	7005	Burnie	261	Rail	..	..	0	22	60	109	110
97	7013	Duncan	7030	Boyer	185	Rail	..	..	100	103	98	87	101
98	7013	Duncan	7000	Hobart	200	Rail	..	..	0	0	0	0	6
99	6027	Collie	6067	Kwinana	165	Rail	..	..	695	740	794	936	774
100	5129	Leigh Creek	5089	Port Augusta	238	Rail	..	..	1 734	1 435	1 420	1 273	1 755

na Not available.

.. Not applicable.

Seac Sea (coastal).

Seao Sea (overseas).

Source BTE (1986c).

TABLE I.3 BROWN COAL TRANSPORT BY ORIGIN-DESTINATION AND MODE: 1980-81 TO 1984-85

Move no.	Origin		Destination		Distance (km)	Prev. Mode	Next move	1980-81	1981-82	1982-83	1983-84	1984-85
	Zone	Name	Zone	Name									('000 tonnes)
1	3127	Morwell	3050	Geelong	217	Rail	..	8	7	6	6	6
2	3127	Morwell	3192	Wangaratta	378	Rail	..	13	16	15	17	15
3	3127	Morwell	3210	Yallourn	22	Rail	..	64	73	47	45	43
4	3127	Morwell	3012	Ballarat	263	Rail	..	10	5	4	2	2
5	3127	Morwell	3197	Warnambool- Dennington	272	Rail	..	21	19	12	14	13
6	3127	Morwell	3056	Tongala	354	Rail	..	14	12	0	11	12
7	3127	Morwell	3047	Colac	297	Rail	..	11	11	14	14	12
8	3127	Morwell	5060	Snuggery	594	Rail	..	1	0	22	42	38
9	3127	Morwell	3081	Boorcan	355	Rail	..	18	18	22	20	21
10	3127	Morwell	3000	Melbourne	144	Rail	..	354	241	190	185	88
11	3009	Bacchus Marsh	3000	Melbourne	51	Rail	..	16	17	14	12	8
12	3000	Melbourne	9000	Overseas	na	Seao	..	71	53	33	98	96

na Not available.
 .. Not applicable.
 Seao Sea (overseas).

Source BTE (1986c).

TABLE I.4 CRUDE OIL TRANSPORT BY ORIGIN-DESTINATION AND MODE: 1980-81 TO 1984-85

Move no.	Origin		Destination		Distance (km)	Prev. Mode	Next move	1980-81 1981-82 1982-83 1983-84 1984-85					
	Zone	Name	Zone	Name				('000 tonnes)					
1	4194	Jackson	4290	Moonie	780	Pipe	..	2	0	0	4	143	894
2	4290	Moonie	4000	Brisbane	306	Pipe	1	..	68	65	67	208	972
3	5129	Moomba	5124	Port Bonython	659	Pipe	..	10	0	0	165	807	888
4	5124	Port Bonython	4000	Brisbane	2 922	Seac	3	..	0	0	0	90	123
5	5124	Port Bonython	3082	Westernport	1 154	Seac	3	..	0	0	0	92	23
6	5124	Port Bonython	6000	Fremantle	2 535	Seac	3	..	0	0	40	129	173
7	5124	Port Bonython	2000	Botany Bay	2 087	Seac	3	..	0	0	0	201	180
8	5124	Port Bonython	2000	Port Jackson	2 087	Seac	3	..	0	0	62	160	160
9	5124	Port Bonython	3050	Geelong	1 128	Seac	3	..	0	0	43	21	22
10	5124	Port Bonython	5000	Port Stanvac	395	Seac	3	..	0	0	20	114	207
11	3159	Gippsland Shelf	3082	Westernport	330	Pipe	..	14	16 312	17 019	16 115	19 207	21 166
12	3082	Westernport	3050	Geelong	135	Pipe	..	..	3 692	4 164	3 901	4 082	3 728
13	3082	Westernport	3000	Melbourne	82	Pipe	..	..	3 091	3 468	3 266	3 417	3 121
14	3082	Westernport	9000	Overseas	na	Seac	..	..	0	0	0	1 164	3 902
15	3082	Westernport	4296	Townsville	2 956	Seac	..	..	0	0	10	0	0
16	3082	Westernport	5124	Port Bonython	1 154	Seac	..	..	0	0	0	30	0
17	3082	Westernport	4000	Brisbane	1 800	Seac	..	..	2 562	2 735	2 688	3 198	3 147
18	3082	Westernport	6000	Fremantle	3 041	Seac	..	..	381	57	265	650	1 128
19	3082	Westernport	2000	Botany Bay	965	Seac	..	..	3 405	3 693	3 356	3 937	3 202
20	3082	Westernport	2000	Port Jackson	965	Seac	..	..	1 378	827	725	735	1 117
21	3082	Westernport	5000	Port Stanvac	827	Seac	..	..	0	23	0	0	0

TABLE I.4 (Cont.) CRUDE OIL TRANSPORT BY ORIGIN-DESTINATION AND MODE: 1980-81 TO 1984-85

Move no.	Origin		Destination		Distance (km)	Prev. Mode	Next move	1980-81	1981-82	1982-83	1983-84	1984-85	
	Zone	Name	Zone	Name									('000 tonnes)
22	6127	Barrow Island	5000	Port Stanvac	3 824	Seac	..	..	325	310	385	406	378
23	6127	Barrow Island	6000	Fremantle	1 506	Seac	..	..	592	515	390	434	381
24	6127	Barrow Island	2000	Port Jackson	5 351	Seac	..	..	271	238	361	176	236
25	6127	Barrow Island	3050	Geelong	4 395	Seac	..	..	46	0	0	0	0
26	6057	Dongara	6000	Kwinana	409	Road	..	..	14	14	12	8	5
27	6014	Blina-Sundown	6014	Northern Highway	29	Pipe	..	28	0	0	0	28	36
28	6014	Northern Highway	6014	Broome	34	Road	27	29	0	0	0	28	36
29	6014	Broome	6000	Fremantle	2 226	Seac	28	..	0	0	0	28	36
30	9000	Overseas	6000	Fremantle	na	Seac	..	..	2 647	2 554	2 328	1 514	992
31	9000	Overseas	2000	Botany Bay	na	Seao	..	..	2 216	2 072	1 402	850	888
32	9000	Overseas	2000	Port Jackson	na	Seao	..	..	665	972	661	626	851
33	9000	Overseas	5000	Port Stanvac	na	Seao	..	..	1 970	1 842	1 512	1 333	1 304
34	9000	Overseas	3000	Melbourne	na	Seao	..	..	174	94	122	44	99
35	9000	Overseas	4000	Brisbane	na	Seao	..	..	1 272	1 251	1 000	638	499

na Not available.

.. Not applicable.

Seac Sea (coastal).

Seao Sea (overseas).

Source BTE (1986c).

TABLE I.5 IRON ORE TRANSPORT BY ORIGIN-DESTINATION AND MODE: 1980-81 TO 1984-85

Move no.	Origin		Destination		Distance (km)	Prev. Mode	Next move	1980-81	1981-82	1982-83	1983-84	1984-85	
	Zone	Name	Zone	Name				('000 tonnes)					
1 ^a	6127	Mount Tom											
		Price	6106	Dampier	343	Rail	..	2	27 681	27 333	31 273	36 806	37 598
2	6106	Dampier	9000	Overseas	na	Seao	1	..	32 009	29 291	29 309	35 812	39 366
3	6045	Mount Newman	6102	Port Hedland	426	Rail	..	5	32 039	32 337	29 303	23 445	28 218
4 ^a	6045	Shay Gap-											
		Sunrise Hill	6102	Port Hedland	192	Rail	..	5	5 359	4 895	4 871	4 737	4 572
5	6102	Port Hedland	9000	Overseas	na	Seao	..	..	28 737	30 070	25 302	28 598	30 102
6	6102	Port Hedland	2116	Newcastle	5 786	Seac	3	..	1 752	1 612	1 079	1 590	1 579
7	6102	Port Hedland	2170	Port Kembla	5 600	Seac	3	..	5 791	4 563	3 171	3 500	3 232
8	6127	Eastern											
		Deepdale	6102	Port Walcott	185	Rail	..	10	14 181	12 900	13 849	13 944	15 722
9	6102	Port Walcott	2116	Newcastle	5 673	Seac	8	..	0	0	0	0	209
10	6102	Port Walcott	9000	Overseas	na	Seao	8	..	14 125	14 655	12 766	15 591	15 576
11	6137	Koolyanobbing	6093	Wundowie	383	Rail	..	..	23	0	0	0	0
12	6137	Koolyanobbing	6000	Fremantle	400	Rail	..	14	1 642	906	562	57	0
13	6000	Fremantle	2116	Newcastle	4 084	Seac	12	..	381	120	234	142	0
14	6000	Fremantle	9000	Overseas	na	Seao	12	..	0	16	0	0	0
15	6000	Fremantle	7027	Launceston	3 239	Seac	12	..	0	0	0	22	0
16	6000	Fremantle	2170	Port Kembla	3 898	Seac	12	..	170	110	222	186	0
17	6126	Yampi Sound	2170	Port Kembla	5 552	Seac	..	..	131	348	323	690	911
18	6126	Yampi Sound	6000	Fremantle	2 504	Seac	..	..	26	0	0	0	0
19	6126	Yampi Sound	9000	Overseas	na	Seao	..	..	2 236	2 300	2 500	2 319	2 211

TABLE I.5 (Cont.) IRON ORE TRANSPORT BY ORIGIN-DESTINATION AND MODE: 1980-81 TO 1984-85

Move no.	Origin		Destination		Distance (km)	Prev. Mode	Next move	1980-81	1981-82	1982-83	1983-84	1984-85
	Zone	Name	Zone	Name									('000 tonnes)
20	6126	Yampi Sound	2116	Newcastle	5 371	Seac	..	111	75	116	218	236
21	5129	Iron Monarch Iron Knob Iron Baron	5124	Whyalla	50	Rail	..	2 000	2 218	2 000	1 864	1 924
22	5124	Whyalla	9000	Overseas	na	Seao	21	95	43	0	123	17
23	5124	Whyalla	2170	Port Kembla	2 015	Seac	21	211	201	7	192	219
24	5124	Whyalla	7027	Launceston	1 370	Seac	21	12	51	62	23	11
25	5124	Whyalla	2116	Newcastle	2 200	Seac	21	997	589	106	19	97
26	7046	Savage River	7007	Port Latta	85	Pipe	..	2 175	2 021	2 294	2 103	2 250
27	7007	Port Latta	9000	Overseas	na	Seao	26	2 195	2 036	2 185	1 957	2 276
28	7007	Port Latta	4251	Mackay	2 663	Seac	26	0	0	0	0	38
29	7007	Port Latta	2170	Port Kembla	943	Seac	26	0	0	0	16	0
30	7007	Port Latta	2116	Newcastle	1 127	Seac	26	0	0	0	0	15
31	9000	Overseas	4251	Mackay	na	Seao	..	27	46	34	30	40

a. Estimates based on production.

na Not available.

.. Not applicable.

Seac Sea (coastal).

Seao Sea (overseas).

Source BTE (1986c).

TABLE I.6 BAUXITE/ALUMINA TRANSPORT BY ORIGIN-DESTINATION AND MODE: 1980-81 TO 1984-85

Move no.	Origin		Destination		Distance (km)	Prev. Mode	Next move	1980-81	1981-82	1982-83	1983-84	1984-85	
	Zone	Name	Zone	Name									
1	4208	Andoom	4301	Weipa	19	Rail	..	3	8 385	9 342	5 456	8 550	8 717
2	4301	Weipa	9000	Overseas	na	Seao	1	..	3 790	4 415	2 590	2 850	3 680
3	4301	Weipa	4225	Gladstone	2 208	Seac	1	4	5 390	5 755	4 991	6 362	5 795
4	4225	Gladstone	9000	Overseas	na	Seao	3	..	2 001	1 658	1 435	1 712	1 471
5	4225	Gladstone	7015	Launceston (Bell Bay)	2 241	Seac	3	..	223	240	235	67	0
6	4225	Gladstone	2116	Newcastle	1 198	Seac	3	7	188	166	125	357	400
7	2116	Newcastle	2035	Kurri Kurri	42	Road	6	..	188	166	125	357	400
8	6108	Jarrahdale	6000	Fremantle	50	Rail	..	13	5 836	5 764	5 180	5 675	5 183
9	6124	Wagerup	6000	Fremantle	109	Rail	..	13	0	0	0	64	45
10	6087	Pinjarra	6000	Fremantle	80	Rail	..	13	959	868	1 173	1 185	1 609
11	6000	Fremantle	2116	Newcastle (Tomago)	4 084	Seac	10	..	0	0	0	68	189
12	6000	Fremantle	7015	Launceston	3 239	Seac	10	..	4	3	3	3	20
13	6000	Fremantle	9000	Overseas	na	Seao	..	..	2 268	2 275	2 370	2 664	2 638
14	6000	Fremantle	3050	Geelong (Port Henry)	3 015	Seac	10	..	130	128	132	67	168
15	6124	Wagerup	6017	Bunbury	65	Rail	..	20	0	0	0	81	526
16	6027	Worsley	6017	Bunbury	57	Rail	..	20	0	0	0	9	759
17	6087	Pinjarra	6017	Bunbury	101	Rail	..	20	1 216	1 199	1 207	1 465	975
18	6017	Bunbury	7015	Launceston (Bell Bay)	3 100	Seac	17	..	0	0	0	168	242

TABLE I.6 (Cont.) BAUXITE/ALUMINA TRANSPORT BY ORIGIN-DESTINATION AND MODE: 1980-81 TO 1984-85

Move no.	Origin		Destination		Distance (km)	Prev. Mode	Next move	1980-81	1981-82	1982-83	1983-84	1984-85	
	Zone	Name	Zone	Name				('000 tonnes)					
19	6017	Bunbury	3050	Geelong (Port Henry)	2 876	Seac	17	..	179	234	300	247	174
20	6017	Bunbury	9000	Overseas	na	Seao	..	..	1 018	962	886	1 145	1 796
21 ^a	8039	Gove	9000	Overseas	na	Seao	..	..	1 178	885	1 189	1 336	1 217
22 ^b	8039	Gove	9000	Overseas	na	Seao	..	..	2 315	1 774	1 929	2 385	2 605

a. Alumina.

b. Bauxite.

na Not available.

.. Not applicable.

Seac Sea (coastal).

Seao Sea (overseas).

Source BTE (1986c).

TABLE I.7 NICKEL (ORE AND CONCENTRATE) TRANSPORT BY ORIGIN-DESTINATION AND MODE: 1980-81 TO 1984-85

Move no.	Origin		Destination		Distance (km)	Prev. Mode	Next move	1980-81	1981-82	1982-83	1983-84	1984-85	
	Zone	Name	Zone	Name									
1	6028	Nepean	6028	Kambalda	50	Road	..	4	87	92	59	10	0
2	6028	Kambalda	6000	Perth	750	Rail	..	..	67	105	56	42	30
3	6000	Fremantle	9000	Overseas	na	Seao	8	..	0	33	24	36	36
4	6028	Kambalda	6059	Kalgoorlie	46	Rail	1	8	255	211	324	347	340
5	6070	Leinster	6070	Leonora	188	Road	..	6	92	74	74	77	71
6	6070	Leonora	6059	Kalgoorlie	280	Rail	5	8	92	74	74	77	71
7	6070	Malcolm	6059	Kalgoorlie	257	Rail	..	8	4	47	40	46	49
8	6059	Kalgoorlie	6000	Perth	706	Rail	6	3	63	58	67	73	76
9	4212	Greenvale	4296	Townsville- Yabulu	215	Rail	..	10	2 585	2 750	2 366	1 441	2 326
10	4296	Townsville	9000	Overseas	na	Seao	9	..	26	28	23	18	19

na Not available.
 .. Not applicable.
 Seao Sea (overseas).

Source BTE (1986c).

TABLE I.8 MINERAL SANDS (CONCENTRATE) TRANSPORT BY ORIGIN-DESTINATION AND MODE: 1980-81 TO 1984-85

Move no.	Origin		Destination		Distance (km)	Prev. Mode	Next move	1980-81	1981-82	1982-83	1983-84	1984-85	
	Zone	Name	Zone	Name				('000 tonnes)					
1	6021	Eneabba	6049	Meru-Geraldton	154	Rail	..	..	712	525	523	527	513
2	6021	Eneabba	6020	Capel	721	Rail	..	3	32	52	38	53	94
3	6020	Capel	6017	Bunbury	38	Rail	7	5	325	223	137	166	171
4	6017	Bunbury	9000	Overseas	na	Seao	3	..	789	681	607	733	892
5	6017	Bunbury	7005	Burnie	3 047	Seac	3	..	59	60	56	62	69
6	6021	Eneabba	6049	Geraldton	159	Rail	..	8	112	139	125	168	220
7	6049	Geraldton	6020	Capel	744	Rail	6	3	30	13	5	0	0
8	6049	Geraldton	9000	Overseas	na	Seao	..	..	551	555	568	748	691
9	6049	Geraldton	6000	Perth	530	Rail	..	10	11	12	11	13	13
10	6000	Fremantle	9000	Overseas	na	Seao	9	..	46	18	20	34	50
11	2000	Botany Bay	9000	Overseas	na	Seao	..	..	5	5	12	13	8
12	2000	Port Jackson	9000	Overseas	na	Seao	..	..	22	30	24	8	5
13	2116	Newcastle	9000	Overseas	na	Seao	..	..	117	102	78	61	82
14	4000	Brisbane	9000	Overseas	na	Seao	..	..	191	133	153	180	270

na Not available.

.. Not applicable.

Seac Sea (coastal).

Seao Sea (overseas).

Source BTE (1986c).

TABLE I.9 MANGANESE ORE TRANSPORT BY ORIGIN-DESTINATION AND MODE: 1980-81 TO 1984-85

Move no.	Origin		Destination		Distance (km)	Prev. Mode	Next move	1980-81	1981-82	1982-83	1983-84	1984-85	
	Zone	Name	Zone	Name				('000 tonnes)					
1	8035	Groote Eylandt	7015	Launceston (Bell Bay)	4 843	Seac	..	..	262	199	156	191	289
2	8035	Groote Eylandt	9000	Overseas	na	Seao	..	..	1 020	1 020	828	1 309	1 440
3	8035	Groote Eylandt	2116	Newcastle	3 837	Seac	..	..	103	26	20	43	30
4	8035	Groote Eylandt	2170	Port Kembla	4 019	Seac	..	..	58	86	62	47	55
5	8035	Groote Eylandt	3050	Geelong	4 932	Seac	..	..	11	11	11	17	10

na Not available.
 .. Not applicable.
 Seac Sea (coastal).
 Seao Sea (overseas).

Source BTE (1986c).

TABLE I.10 LEAD AND ZINC (ORE AND CONCENTRATE) TRANSPORT BY ORIGIN-DESTINATION AND MODE: 1980-81 TO 1984-85

Move no.	Origin		Destination		Distance (km)	Prev. Mode	Next move	1980-81	1981-82	1982-83	1983-84	1984-85	
	Zone	Name	Zone	Name									('000 tonnes)
1	4262	Mount Isa	4296	Townsville	981	Rail	..	2	332	414	488	633	615
2	4296	Townsville	9000	Overseas	na	Seao	1	..	243	314	421	377	386
3	4296	Townsville	7000	Risdon (Hobart)	2 971	Seac	1	..	94	110	63	47	41
4	4296	Townsville	5094	Port Pirie	4 080	Seac	1	..	0	0	0	0	38
5	6070	Teutonic Bore	6070	Leonora	60	Road	..	6	13	61	90	65	61
6	6070	Leonora	6046	Esperance	645	Rail	5	7	13	61	90	65	61
7	6046	Esperance	9000	Overseas	na	Seao	6	..	0	41	90	61	62
8	6046	Esperance	6000	Fremantle	1 015	Seac	6	..	0	6	0	0	0
9	6046	Esperance	6017	Bunbury	876	Seac	6	..	0	11	0	0	0
10	6046	Esperance	2116	Newcastle	3 193	Seac	6	..	0	11	0	0	0
11	2036	Elura	5094	Port Pirie	826	Rail	..	13	0	0	0	8	27
12 ^a	2025	Broken Hill	5094	Port Pirie	363	Rail	..	13	680	795	811	660	690
13	5094	Port Pirie	9000	Overseas	na	Seao	12	..	271	278	346	375	322
14	5094	Port Pirie	7000	Risdon (Hobart)	1 683	Seac	12	..	194	192	152	125	126
15	2025	Broken Hill	5000	Adelaide	514	Rail	..	16	20	20	20	23	18
16	5000	Adelaide	9000	Overseas	na	Seao	15	..	14	10	20	17	21
17	2025	Broken Hill	2116	Newcastle	1 349	Rail	..	21	65	52	43	42	64
18	2107	Woodlawn	2116	Newcastle	9	Rail	..	21	87	211	191	151	150
19	2168	Exeter	2116	Newcastle	295	Rail	..	21	0	18	0	0	0
20	2036	Elura	2116	Newcastle (Cockle Creek)	892	Rail	..	21	26	24	58	191	215
21	2116	Newcastle	9000	Overseas	na	Seao	..	..	142	103	72	101	100

TABLE I.20 TALC TRANSPORT BY ORIGIN-DESTINATION AND MODE: 1980-81 TO 1984-85

Move no.	Origin		Destination		Distance (km)	Prev. Mode	Next move	1980-81 1981-82 1982-83 1983-84 1984-85					
	Zone	Name	Zone	Name				('000 tonnes)					
1	6116	Three Springs	6049	Geraldton	182	Rail	..	5	48	44	89	118	133
2	6116	Three Springs	6000	Fremantle	348	Rail	..	4	17	18	2	4	5
3	6086	Mount Seabrook	6000	Fremantle	850	Road	..	5	18	17	22	22	4
4	6000	Fremantle	9000	Overseas	na	Seao	..	..	30	27	23	18	9
5	6049	Geraldton	9000	Overseas	na	Seao	1	..	62	52	77	140	115
6	5129	Lyndhurst	5000	Adelaide	581	Rail	..	..	10	9	4	9	10

na Not available.

.. Not applicable.

Seao Sea (overseas).

Source BTE (1986).

APPENDIX II SUMMARY STATISTICS

This appendix provides summary statistics of mineral movements by mode. Data are provided for each mineral and mineral group in tonnes and tonne-kilometres from 1980-81 to 1984-85.

TABLE II.1 TRANSPORT OF MINERALS BY MODE: MINERALS INCLUDED IN THE REVIEW, AUSTRALIA, 1980-81 TO 1984-85

Mode	Year				
	1980-81	1981-82	1982-83	1983-84	1984-85
Pipeline					
Tonnes ('000)	18 830.0	19 213.0	19 170.0	22 778.0	26 012.0
Per cent	5.0	5.2	5.3	5.4	5.5
Tonne-km (m)	6 350.2	6 658 .3	6 458.3	7 932.5	9 540.8
Per cent	4.8	5.5	5.9	6.2	7.0
Road					
Tonnes ('000)	10 117.0	8 441.0	7 411.0	8 193.0	10 784.0
Per cent	2.7	2.3	2.0	1.9	2.3
Tonne-km (m)	739.1	519.8	480.0	542.7	478.4
Per cent	0.6	0.4	0.4	0.4	0.3
Rail					
Tonnes ('000)	154 439.0	159 161.0	159 666.0	181 134.0	201 914.0
Per cent	41.3	42.6	43.7	42.7	42.5
Tonne-km (m)	39 807.8	40 595.4	41 193.2	43 682.0	49 664.9
Per cent	30.3	33.3	37.7	34.2	36.2
Coastal ship					
Tonnes ('000)	29 071.0	26 800.0	23 135.0	28 821.0	28 863.0
Per cent	7.8	7.2	6.3	6.8	6.1
Tonne-km (m)	84 639.4	74 003.8	61 253.3	75 494.6	77 565.9
Per cent	64.3	60.8	56.0	59.2	56.5
Overseas ship					
Export					
Tonnes ('000)	149 282.0	147 560.0	145 987.0	175 928.0	200 360.0
Per cent	39.9	39.5	40.0	41.5	42.2
Import					
Tonnes ('000)	12 408.0	12 131.0	9 923.0	7 619.0	7 350.0
Per cent	3.3	3.2	2.7	1.8	1.5
Total					
Tonnes ('000)	374 147.0	373 306.0	365 292.0	424 473.0	475 283.0
Tonne-km (m)	131 536.5	121 777.3	109 384.8	127 651.8	137 250.0

Source BTE (1986c).

TABLE II.2 TRANSPORT OF FUEL MINERALS BY MODE: AUSTRALIA, 1980-81 TO 1984-85

Mode	Year				
	1980-81	1981-82	1982-83	1983-84	1984-85
Pipeline					
Tonnes ('000)	16 380.0	17 084.0	16 347.0	20 028.0	23 062.0
Per cent	12.1	12.3	11.2	10.8	10.5
Tonne-km (m)	6 155.7	6 482.7	6 244.8	7 731.1	9 325.0
Per cent	18.8	20.4	18.8	18.6	19.5
Road					
Tonnes ('000)	8 292.0	7 000.0	5 915.0	6 299.0	9 009.0
Per cent	6.1	5.0	4.0	3.4	4.1
Tonne-km (m)	301.4	263.8	208.9	198.8	279.2
Per cent	0.9	0.8	0.6	0.5	0.6
Rail					
Tonnes ('000)	44 277.0	49 920.0	54 420.0	73 678.0	85 270.0
Per cent	32.7	35.8	37.2	39.8	38.8
Tonne-km (m)	9 265.1	10 336.9	11 016.9	14 376.5	17 404.6
Per cent	28.3	32.5	33.2	34.6	36.3
Coastal ship					
Tonnes ('000)	10 393.0	9 802.0	9 388.0	12 700.0	13 009.0
Per cent	7.6	7.0	6.4	6.9	5.9
Tonne-km (m)	16 976.2	14 735.6	15 685.9	19 267.1	20 889.1
Per cent	51.9	46.3	47.3	46.3	43.6
Overseas ship					
Export					
Tonnes ('000)	46 941.0	46 853.0	53 257.0	67 516.0	84 945.0
Per cent	34.7	33.6	36.4	36.5	38.6
Import					
Tonnes ('000)	8 944.0	8 785.0	7 025.0	5 005.0	4 633.0
Per cent	6.6	6.3	4.8	2.7	2.1
Total					
Tonnes ('000)	135 227.0	139 444.0	146 352.0	185 226.0	219 928.0
Tonne-km (m)	32 698.4	31 819.0	33 156.5	41 573.5	47 897.9

Source BTE (1986c).

TABLE II.3 TRANSPORT OF METALLIC MINERALS BY MODE: AUSTRALIA, 1980-81 TO 1984-85

Mode	Year				
	1980-81	1981-82	1982-83	1983-84	1984-85
Pipeline					
Tonnes ('000)	2 175.0	2 021.0	2 294.0	2 103.0	2 250.0
Per cent	1.0	0.9	1.1	1.0	1.0
Tonne-km (m)	184.9	171.8	195.0	178.8	191.3
Per cent	0.2	0.2	0.3	0.2	0.2
Road					
Tonnes ('000)	567.0	754.0	773.0	913.0	981.0
Per cent	0.3	0.4	0.4	0.4	0.4
Tonne-km (m)	171.4	134.3	122.9	141.6	70.7
Per cent	0.2	0.2	0.2	0.2	0.1
Rail					
Tonnes ('000)	105 478.0	104 316.0	100 885.0	103 102.0	112 175.0
Per cent	47.9	48.4	50.1	46.6	47.3
Tonne-km (m)	30 056.2	29 642.2	29 623.3	28 924.6	31 825.1
Per cent	31.5	34.2	40.4	34.7	36.9
Coastal ship					
Tonnes ('000)	16 158.0	14 635.0	11 463.0	14 290.0	14 111.0
Per cent	7.3	6.8	5.7	6.5	6.0
Tonne-km (m)	65 142.5	56 837.7	43 416.2	54 109.2	54 158.4
Per cent	68.2	65.5	59.2	64.9	62.8
Overseas ship					
Export					
Tonnes ('000)	95 556.0	93 948.0	86 041.0	100 842.0	107 691.0
Per cent	43.4	43.5	42.7	45.6	45.4
Import					
Tonnes ('000)	71.0	87.0	58.0	69.0	81.0
Per cent	-	-	-	-	-
Total					
Tonnes ('000)	220 005.0	215 761.0	201 514.0	221 319.0	237 289.0
Tonne-km (m)	95 555.0	86 786.0	73 357.4	83 354.2	86 245.5

- Less than 0.05 per cent.

Source BTE (1986c).

TABLE II.4 TRANSPORT OF NON-METALLIC MINERALS BY MODE: AUSTRALIA,
1980-81 TO 1984-85

Mode	Year				
	1980-81	1981-82	1982-83	1983-84	1984-85
Pipeline					
Tonnes ('000)	275.0	108.0	529.0	647.0	700.0
Per cent	1.5	0.6	3.0	3.6	3.9
Tonne-km (m)	9.6	3.8	18.5	22.6	24.5
Per cent	0.3	0.1	0.6	0.8	0.8
Road					
Tonnes ('000)	715.0	687.0	723.0	981.0	794.0
Per cent	3.9	3.8	4.2	5.5	4.4
Tonne-km (m)	119.7	121.7	148.1	202.3	128.5
Per cent	3.8	3.8	5.2	7.4	4.1
Rail					
Tonnes ('000)	4 684.0	4 925.0	4 361.0	4 354.0	4 469.0
Per cent	25.5	27.2	25.0	24.3	24.7
Tonne-km (m)	486.5	616.3	553.0	380.9	435.2
Per cent	15.5	19.4	19.3	14.0	14.0
Coastal ship					
Tonnes ('000)	2 520.0	2 363.0	2 284.0	1 831.0	1 743.0
Per cent	13.7	13.1	13.1	10.2	9.6
Tonne-km (m)	2 520.7	2 430.6	2 151.1	2 118.4	2 518.4
Per cent	80.4	76.6	74.9	77.8	81.1
Overseas ship					
Export					
Tonnes ('000)	6 785.0	6 759.0	6 689.0	7 570.0	7 724.0
Per cent	36.9	37.3	38.4	42.2	42.8
Import					
Tonnes ('000)	3 392.0	3 259.0	2 840.0	2 545.0	2 636.0
Per cent	18.5	18.0	16.3	14.2	14.6
Total					
Tonnes ('000)	18 372.0	18 101.0	17 426.0	17 928.0	18 066.0
Tonne-km (m)	3 136.6	3 172.4	2 870.7	2 724.3	3 106.6

Source BTE (1986c).

TABLE II.5 TRANSPORT OF BLACK COAL BY MODE: AUSTRALIA, 1980-81 TO 1984-85

Mode	Year				
	1980-81	1981-82	1982-83	1983-84	1984-85
Road					
Tonnes ('000)	8 278.0	6 986.0	5 903.0	6 263.0	8 968.0
Per cent	8.3	6.7	5.2	4.2	5.1
Tonne-km (m)	295.7	258.1	204.0	194.6	275.9
Per cent	2.4	2.1	1.6	1.2	1.4
Rail					
Tonnes ('000)	43 747.0	49 501.0	54 074.0	73 310.0	85 012.0
Per cent	43.6	47.3	47.3	49.5	47.9
Tonne-km (m)	9 181.7	10 271.8	10 951.5	14 296.1	17 341.7
Per cent	74.8	81.8	84.6	85.3	85.7
Coastal ship					
Tonnes ('000)	1 433.0	1 404.0	1 043.0	2 299.0	2 496.0
Per cent	1.4	1.3	0.9	1.6	1.4
Tonne-km (m)	2 803.7	2 023.8	1 795.5	2 262.4	2 623.5
Per cent	22.8	16.1	13.9	13.5	13.0
Overseas ship					
Export					
Tonnes ('000)	46 870.0	46 800.0	53 224.0	66 254.0	80 947.0
Per cent	46.7	44.7	46.6	44.7	45.6
Total					
Tonnes ('000)	100 328.0	104 691.0	114 244.0	148 126.0	177 423.0
Tonne-km (m)	12 281.1	12 553.7	12 951.0	16 753.1	20 241.1

Source BTE (1986c).

TABLE II.6 TRANSPORT OF BROWN COAL BY MODE: AUSTRALIA, 1980-81 TO 1984-85

Mode	Year				
	1980-81	1981-82	1982-83	1983-84	1984-85
Rail					
Tonnes ('000)	530.0	419.0	346.0	368.0	258.0
Per cent	88.1	88.7	91.2	78.9	72.8
Tonne-km (m)	83.4	65.1	65.4	80.4	62.9
Per cent	100.0	100.0	100.0	100.0	100.0
Overseas ship					
Export					
Tonnes ('000)	71.0	53.0	33.0	98.0	96.0
Per cent	11.8	11.2	8.7	21.0	27.1
Total					
Tonnes ('000)	601.0	472.0	379.0	466.0	354.0
Tonne-km (m)	83.4	65.1	65.4	80.4	62.9

Source BTE (1986c).

TABLE II.7 TRANSPORT OF CRUDE OIL BY MODE: AUSTRALIA, 1980-81 TO 1984-85

Mode	Year				
	1980-81	1981-82	1982-83	1983-84	1984-85
Pipeline					
Tonnes ('000)	23 163.0	24 716.0	23 514.0	27 527.0	29 911.0
Per cent	56.3	58.9	60.4	62.3	61.0
Tonne-km (m)	6 155.7	6 482.7	6 244.8	7 731.1	9 325.0
Per cent	30.2	33.7	31.0	31.2	33.7
Road					
Tonnes ('000)	14.0	14.0	12.0	36.0	41.0
Per cent	-	-	-	0.1	0.1
Tonne-km (m)	5.7	5.7	4.9	4.2	3.3
Per cent	-	-	-	-	-
Coastal ship					
Tonnes ('000)	8 960.0	8 398.0	8 345.0	10 401.0	10 513.0
Per cent	21.8	20.0	21.4	23.5	21.4
Tonne-km (m)	14 172.5	12 711.7	13 890.5	17 004.7	18 265.6
Per cent	69.6	66.2	68.9	68.7	66.1
Overseas ship					
Export					
Tonnes ('000)	..	..	..	1 164.0	3 902.0
Per cent	..	..	..	2.6	7.9
Import					
Tonnes ('000)	8 944.0	8 785.0	7 025.0	5 005.0	4 633.0
Per cent	21.7	20.9	18.0	11.3	9.4
Total					
Tonnes ('000)	41 081.0	41 913.0	38 896.0	44 133.0	49 000.0
Tonne-km (m)	20 333.8	19 200.1	20 140.1	24 740.0	27 593.8

- Less than 0.05 per cent.

.. Not applicable.

Source BTE (1986c).

TABLE II.8 TRANSPORT OF IRON ORE BY MODE: AUSTRALIA, 1980-81 TO 1984-85

Mode	Year				
	1980-81	1981-82	1982-83	1983-84	1984-85
Pipeline					
Tonnes ('000)	2 175.0	2 021.0	2 294.0	2 103.0	2 250.0
Per cent	1.2	1.2	1.4	1.2	1.2
Tonne-km (m)	184.9	171.8	195.0	178.8	191.3
Per cent	0.2	0.3	0.3	0.3	0.3
Rail					
Tonnes ('000)	82 925.0	80 589.0	81 858.0	80 853.0	88 034.0
Per cent	47.6	47.8	50.7	46.5	47.2
Tonne-km (m)	27 561.3	26 950.4	27 031.9	26 217.1	28 799.6
Per cent	36.0	40.2	48.4	42.3	44.6
Coastal ship					
Tonnes ('000)	9 582.0	7 669.0	5 320.0	6 598.0	6 547.0
Per cent	5.5	4.5	3.3	3.8	3.5
Tonne-km (m)	48 808.9	39 904.3	28 570.3	35 653.0	35 534.2
Per cent	63.8	59.5	51.2	57.5	55.1
Overseas ship					
Export					
Tonnes ('000)	79 397.0	78 411.0	72 062.0	84 400.0	89 548.0
Per cent	45.6	46.5	44.6	48.5	48.0
Import					
Tonnes ('000)	27.0	46.0	34.0	30.0	40.0
Per cent	-	-	-	-	-
Total					
Tonnes ('000)	174 106.0	168 736.0	161 568.0	173 984.0	186 419.0
Tonne-km (m)	76 555.1	67 026.5	55 797.2	62 048.9	64 525.1

- Less than 0.05 per cent.

Source BTE (1986c).

TABLE II.9 TRANSPORT OF BAUXITE AND ALUMINA BY MODE: AUSTRALIA,
1980-81 TO 1984-85

Mode	Year				
	1980-81	1981-82	1982-83	1983-84	1984-85
Road					
Tonnes ('000)	188.0	166.0	125.0	357.0	400.0
Per cent	0.5	0.4	0.4	0.9	1.0
Tonne-km (m)	7.9	7.0	5.3	15.0	16.8
Per cent	-	-	-	0.1	0.1
Rail					
Tonnes ('000)	16 396.0	17 173.0	13 016.0	17 029.0	17 814.0
Per cent	47.0	48.4	44.9	46.7	46.6
Tonne-km (m)	650.7	656.2	578.4	701.7	734.3
Per cent	4.5	4.3	4.2	4.1	4.4
Coastal ship					
Tonnes ('000)	5 703.0	6 120.0	5 426.0	6 915.0	6 588.0
Per cent	16.3	17.2	18.7	19.0	17.2
Tonne-km (m)	13 545.8	14 512.4	12 967.0	16 345.7	15 868.4
Per cent	95.3	95.6	95.6	95.7	95.4
Overseas ship					
Export					
Tonnes ('000)	12 570.0	11 969.0	10 399.0	12 092.0	13 407.0
Per cent	36.0	33.7	35.9	33.2	35.0
Total					
Tonnes ('000)	34 857.0	35 428.0	28 966.0	36 393.0	38 209.0
Tonne-km (m)	14 204.3	15 175.6	13 550.7	17 062.4	16 619.5

- Less than 0.05 per cent.

Source BTE (1986c).

TABLE II.10 TRANSPORT OF NICKEL (ORE AND CONCENTRATE) BY MODE:
AUSTRALIA, 1980-81 TO 1984-85

Mode	Year				
	1980-81	1981-82	1982-83	1983-84	1984-85
Road					
Tonnes ('000)	179.0	166.0	133.0	87.0	71.0
Per cent	5.5	4.8	4.3	4.1	2.4
Tonne-km (m)	21.6	18.5	16.9	15.0	13.3
Per cent	3.0	2.3	2.5	3.2	2.0
Rail					
Tonnes ('000)	3 003.0	3 187.0	2 860.0	1 953.0	2 821.0
Per cent	93.6	93.3	94.0	93.2	95.7
Tonne-km (m)	689.0	753.5	643.9	442.2	624.4
Per cent	96.9	97.6	97.4	96.7	97.9
Overseas ship					
Export					
Tonnes ('000)	26.0	61.0	47.0	54.0	55.0
Per cent	0.8	1.7	1.5	2.5	1.8
Total					
Tonnes ('000)	3 208.0	3 414.0	3 040.0	2 094.0	2 947.0
Tonne-km (m)	710.7	772.0	660.8	457.2	637.7

Source BTE (1986c).

TABLE II.11 TRANSPORT OF MINERAL SANDS (CONCENTRATE) BY MODE:
AUSTRALIA, 1980-81 TO 1984-85

Mode	Year				
	1980-81	1981-82	1982-83	1983-84	1984-85
Rail					
Tonnes ('000)	1 162.0	938.0	829.0	927.0	1 011.0
Per cent	39.4	37.1	35.3	33.5	32.8
Tonne-km (m)	191.0	164.9	142.6	159.3	195.1
Per cent	51.5	47.4	45.5	45.7	48.1
Coastal ship					
Tonnes ('000)	59.0	60.0	56.0	62.0	69.0
Per cent	2.0	2.3	2.3	2.2	2.2
Tonne-km (m)	179.8	182.8	170.6	188.9	210.2
Per cent	48.4	52.5	54.4	54.2	51.8
Overseas ship					
Export					
Tonnes ('000)	1 721.0	1 524.0	1 462.0	1 777.0	1 998.0
Per cent	58.4	60.4	62.2	64.2	64.9
Total					
Tonnes ('000)	2 942.0	2 522.0	2 347.0	2 766.0	3 078.0
Tonne-km (m)	370.8	347.8	313.2	348.2	405.4

Source BTE (1986c).

TABLE II.12 TRANSPORT OF MANGANESE ORE BY MODE: AUSTRALIA, 1980-81 TO 1984-85

Mode	Year				
	1980-81	1981-82	1982-83	1983-84	1984-85
Coastal ship					
Tonnes ('000)	434.0	322.0	249.0	298.0	384.0
Per cent	29.8	23.9	23.1	18.5	21.0
Tonne-km (m)	1 951.4	1 463.4	1 135.7	1 362.7	1 785.1
Per cent	100.0	100.0	100.0	100.0	100.0
Overseas ship					
Export					
Tonnes ('000)	1 020.0	1 020.0	828.0	1 309.0	1 440.0
Per cent	70.1	76.0	76.8	81.4	78.9
Total					
Tonnes ('000)	1 454.0	1 342.0	1 077.0	1 607.0	1 824.0
Tonne-km (m)	1 951.4	1 463.4	1 135.7	1 362.7	1 785.1

Source BTE (1986c).

TABLE II.13 TRANSPORT OF LEAD, ZINC AND COPPER (ORE AND CONCENTRATE)
BY MODE: AUSTRALIA, 1980-81 TO 1984-85

Mode	Year				
	1980-81	1981-82	1982-83	1983-84	1984-85
Road					
Tonnes ('000)	197.0	418.0	511.0	465.0	507.0
Per cent	5.7	9.7	11.3	10.2	10.5
Tonne-km (m)	141.3	108.0	99.9	110.7	39.9
Per cent	8.0	5.4	5.2	5.3	1.7
Rail					
Tonnes ('000)	1 992.0	2 428.0	2 323.0	2 403.0	2 495.0
Per cent	58.0	56.3	51.5	53.0	51.9
Tonne-km (m)	962.0	1 114.9	1 226.6	1 411.8	1 471.7
Per cent	54.6	55.8	64.5	67.8	64.7
Coastal ship					
Tonnes ('000)	380.0	464.0	412.0	417.0	523.0
Per cent	11.0	10.7	9.1	9.2	10.8
Tonne-km (m)	656.6	774.8	572.6	558.8	760.5
Per cent	37.3	38.7	30.1	26.8	33.4
Overseas ship					
Export					
Tonnes ('000)	820.0	958.0	1 239.0	1 206.0	1 240.0
Per cent	23.8	22.2	27.4	26.6	25.8
Import					
Tonnes ('000)	44.0	41.0	24.0	39.0	41.0
Per cent	1.2	0.9	0.5	0.8	0.8
Total					
Tonnes ('000)	3 433.0	4 309.0	4 509.0	4 530.0	4 806.0
Tonne-km (m)	1 759.9	1 997.7	1 899.1	2 081.2	2 272.0

Source BTE (1986c).

TABLE II.14 TRANSPORT OF URANIUM (CONCENTRATE) BY MODE: AUSTRALIA, .
1980-81 TO 1984-85

Mode	Year				
	1980-81	1981-82	1982-83	1983-84	1984-85
Road					
Tonnes ('000)	3.0	4.0	4.0	4.0	3.0
Per cent	50.0	40.0	50.0	50.0	50.0
Tonne-km (m)	0.6	0.8	0.9	0.9	0.7
Per cent	19.7	25.7	100.0	100.0	100.0
Rail					
Tonnes ('000)	1.0	1.0	..	..	..
Per cent	16.6	10.0	..	..	..
Tonne-km (m)	2.3	2.3	..	..	..
Per cent	80.2	74.2	..	..	..
Overseas ship					
Export					
Tonnes ('000)	2.0	5.0	4.0	4.0	3.0
Per cent	33.3	50.0	50.0	50.0	50.0
Total					
Tonnes ('000)	6.0	10.0	8.0	8.0	6.0
Tonne-km (m)	2.8	3.0	0.9	0.9	0.7

.. Not applicable.

Source BTE (1986c).

TABLE II.15 TRANSPORT OF LIMESTONE BY MODE: AUSTRALIA, 1980-81 TO 1984-85

Mode	Year				
	1980-81	1981-82	1982-83	1983-84	1984-85
Pipeline					
Tonnes ('000)	275.0	108.0	529.0	647.0	700.0
Per cent	4.5	1.9	9.9	12.3	13.5
Tonne-km (m)	9.6	3.8	18.5	22.6	24.5
Per cent	1.9	0.9	5.3	7.6	8.4
Road					
Tonnes ('000)	71.0	88.0	101.0	100.0	98.0
Per cent	1.1	1.6	1.8	1.9	1.9
Tonne-km (m)	6.6	12.3	16.7	16.5	18.6
Per cent	1.3	2.9	4.7	5.5	6.3
Rail					
Tonnes ('000)	3 400.0	3 259.0	2 862.0	2 986.0	2 963.0
Per cent	56.3	59.9	53.5	57.2	57.5
Tonne-km (m)	260.2	254.2	211.3	195.7	211.6
Per cent	51.5	61.1	60.6	65.7	72.6
Coastal ship					
Tonnes ('000)	1 050.0	875.0	1 012.0	587.0	364.0
Per cent	17.3	16.0	18.9	11.2	7.0
Tonne-km (m)	228.3	145.5	101.6	63.0	36.5
Per cent	45.2	34.9	29.1	21.1	12.5
Overseas ship					
Import					
Tonnes ('000)	1 242.0	1 106.0	837.0	898.0	1 028.0
Per cent	20.5	20.3	15.6	17.2	19.9
Total					
Tonnes ('000)	6 038.0	5 436.0	5 341.0	5 218.0	5 153.0
Tonne-km (m)	504.7	415.7	348.1	297.8	291.1

Source BTE (1986c).

TABLE II.16 TRANSPORT OF DOLOMITE BY MODE: AUSTRALIA, 1980-81 TO 1984-85

Mode	Year				
	1980-81	1981-82	1982-83	1983-84	1984-85
Rail					
Tonnes ('000)	27.0	27.0	21.0	51.0	95.0
Per cent	3.6	4.7	4.3	10.1	17.0
Tonne-km (m)	18.6	18.6	14.5	12.4	21.3
Per cent	1.4	2.1	2.0	1.7	3.0
Coastal ship					
Tonnes ('000)	721.0	546.0	459.0	453.0	462.0
Per cent	96.3	95.2	95.6	89.8	82.9
Tonne-km (m)	1 234.5	838.6	697.3	689.7	681.7
Per cent	98.5	97.8	97.9	98.2	96.9
Total					
Tonnes ('000)	748.0	573.0	480.0	504.0	557.0
Tonne-km (m)	1 253.1	857.2	711.7	702.1	703.0

Source BTE (1986c).

TABLE II.17 TRANSPORT OF CLAY BY MODE: AUSTRALIA, 1980-81 TO 1984-85

Mode	Year				
	1980-81	1981-82	1982-83	1983-84	1984-85
Road					
Tonnes ('000)	39.0	34.0	39.0	51.0	21.0
Per cent	32.0	33.0	39.0	42.9	25.9
Tonne-km (m)	15.4	21.4	35.3	29.6	7.2
Per cent	65.6	73.1	82.6	81.3	46.8
Rail					
Tonnes ('000)	47.0	45.0	41.0	37.0	44.0
Per cent	38.5	43.7	41.0	31.1	54.3
Tonne-km (m)	8.1	7.8	7.4	6.8	8.1
Per cent	34.3	26.8	17.3	18.6	53.1
Overseas ship					
Export					
Tonnes ('000)	..	..	..	12.0	14.0
Per cent	..	..	..	10.0	17.3
Import					
Tonnes (000)	36.0	24.0	20.0	19.0	2.0
Per cent	29.5	23.3	20.0	16.0	2.5
Total					
Tonnes ('000)	122.0	103.0	100.0	119.0	81.0
Tonne-km (m)	23.5	29.2	42.7	36.5	15.3

.. Not applicable.

Source BTE (1986c).

TABLE II.18 TRANSPORT OF SALT BY MODE: AUSTRALIA, 1980-81 TO 1984-85

Mode	Year				
	1980-81	1981-82	1982-83	1983-84	1984-85
Road					
Tonnes ('000)	191.0	161.0	139.0	150.0	137.0
Per cent	4.0	3.9	3.0	2.9	2.5
Tonne-km (m)	45.7	36.9	34.5	40.8	27.7
Per cent	13.7	11.6	11.9	12.6	8.0
Rail					
Tonnes ('000)	170.0	65.0	40.0	44.0	64.0
Per cent	3.5	1.5	0.8	0.8	1.2
Tonne-km (m)	50.3	26.4	14.4	13.9	17.1
Per cent	15.1	8.3	5.0	4.3	4.9
Coastal ship					
Tonnes ('000)	179.0	183.0	173.0	188.0	185.0
Per cent	3.7	4.4	3.8	3.7	3.4
Tonne-km (m)	236.6	252.9	238.8	267.5	301.6
Per cent	71.1	79.9	83.0	83.0	87.0
Overseas ship					
Export					
Tonnes ('000)	4 198.0	3 684.0	4 163.0	4 673.0	4 944.0
Per cent	88.6	90.0	92.2	92.4	92.7
Total					
Tonnes ('000)	4 738.0	4 093.0	4 515.0	5 055.0	5 330.0
Tonne-km (m)	332.6	316.1	287.7	322.2	346.4

Source BTE (1986c).

TABLE II.19 TRANSPORT OF SILICA BY MODE: AUSTRALIA, 1980-81 TO 1984-85

Mode	Year				
	1980-81	1981-82	1982-83	1983-84	1984-85
Road					
Tonnes ('000)	340.0	328.0	322.0	289.0	266.0
Per cent	29.9	30.7	28.7	23.3	19.6
Tonne-km (m)	26.3	25.6	25.6	26.0	22.5
Per cent	46.9	36.0	29.5	26.8	28.7
Rail					
Tonnes ('000)	218.0	229.0	241.0	231.0	226.0
Per cent	19.2	21.4	21.5	18.6	16.7
Tonne-km (m)	17.4	18.0	18.7	17.3	17.6
Per cent	31.0	25.3	21.5	17.8	22.4
Coastal ship					
Tonnes ('000)	9.0	20.0	31.0	39.0	28.0
Per cent	0.7	1.8	2.7	3.1	2.0
Tonne-km (m)	12.3	27.4	42.5	53.4	38.4
Per cent	22.0	38.5	48.9	55.2	48.8
Overseas ship					
Export					
Tonnes ('000)	567.0	489.0	525.0	680.0	832.0
Per cent	50.0	45.8	46.9	54.8	61.5
Total					
Tonnes ('000)	1 134.0	1 066.0	1 119.0	1 239.0	1 352.0
Tonne-km (m)	56.0	71.0	86.8	96.7	78.5

Source BTE (1986c).

TABLE II.20 TRANSPORT OF GYPSUM BY MODE: AUSTRALIA, 1980-81 TO 1984-85

Mode	Year				
	1980-81	1981-82	1982-83	1983-84	1984-85
Road					
Tonnes ('000)	50.0	53.0	94.0	361.0	260.0
Per cent	2.6	2.0	4.2	13.4	10.4
Tonne-km (m)	9.9	10.5	16.8	70.0	48.4
Per cent	0.8	0.7	1.3	5.5	2.9
Rail					
Tonnes ('000)	774.0	1 080.0	914.0	874.0	921.0
Per cent	40.8	41.2	41.7	32.5	37.0
Tonne-km (m)	108.2	115.3	113.1	106.7	119.3
Per cent	9.5	8.1	8.8	8.3	7.1
Coastal ship					
Tonnes ('000)	561.0	657.0	544.0	564.0	704.0
Per cent	29.5	25.1	24.8	21.0	28.3
Tonne-km (m)	1 020.0	1 295.7	1 153.6	1 096.6	1 489.7
Per cent	89.6	91.1	89.8	86.1	89.8
Overseas ship					
Export					
Tonnes ('000)	511.0	827.0	636.0	885.0	600.0
Per cent	26.9	31.6	29.0	32.9	24.1
Total					
Tonnes ('000)	1 896.0	2 617.0	2 188.0	2 684.0	2 485.0
Tonne-km (m)	1 138.2	1 421.5	1 283.5	1 273.3	1 657.5

Source BTE (1986c).

TABLE II.21 TRANSPORT OF PHOSPHATE ROCK BY MODE: AUSTRALIA, 1980-81 TO 1984-85

Mode	Year				
	1980-81	1981-82	1982-83	1983-84	1984-85
Road					
Tonnes ('000)	6.0	6.0	6.0	8.0	8.0
Per cent	0.1	0.1	0.1	0.2	0.2
Tonne-km (m)	0.5	0.5	0.5	0.7	0.7
Per cent	13.9	0.3	0.3	100.0	7.4
Rail					
Tonnes ('000)	3.0	149.0	147.0	..	8.0
Per cent	0.1	3.6	4.2	..	0.2
Tonne-km (m)	3.2	156.5	154.4	..	8.4
Per cent	86.0	99.6	99.6	..	92.5
Coastal ship					
Tonnes ('000)	..	82.0	65.0	..	..
Per cent	..	2.0	1.8	..	..
Tonne-km (m)	..	na	na	..	..
Per cent	..	na	na	..	..
Overseas ship					
Export					
Tonnes ('000)	1 417.0	1 680.0	1 265.0	1 162.0	1 210.0
Per cent	40.0	41.5	36.4	40.7	42.7
Import					
Tonnes ('000)	2 115.0	2 129.0	1 983.0	1 682.0	1 606.0
Per cent	59.7	52.6	57.2	58.9	56.7
Total					
Tonnes ('000)	3 541.0	4 046.0	3 466.0	2 852.0	2 832.0
Tonne-km (m)	3.7	157.0	154.9	0.7	9.1

.. Not applicable.

na Not available.

Source BTE (1986c).

TABLE II.22 TRANSPORT OF TALC BY MODE: AUSTRALIA, 1980-81 TO 1984-85

Mode	Year				
	1980-81	1981-82	1982-83	1983-84	1984-85
Road					
Tonnes ('000)	18.0	17.0	22.0	22.0	4.0
Per cent	9.7	10.1	10.1	7.0	1.4
Tonne-km (m)	15.3	14.5	18.7	18.7	3.4
Per cent	42.7	42.5	49.3	39.9	9.6
Rail					
Tonnes ('000)	75.0	71.0	95.0	131.0	148.0
Per cent	40.5	42.5	43.7	42.1	53.6
Tonne-km (m)	20.5	19.5	19.2	28.1	31.8
Per cent	57.2	57.4	50.6	60.0	90.3
Overseas ship					
Export					
Tonnes ('000)	92.0	79.0	100.0	158.0	124.0
Per cent	49.7	47.3	46.0	50.8	44.9
Total					
Tonnes ('000)	185.0	167.0	217.0	311.0	276.0
Tonne-km (m)	35.8	34.0	37.9	46.8	35.2

Source BTE (1986c).

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Abbreviations

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AGPS	Australian Government Publishing Service
BTE	Federal Bureau of Transport Economics
DoT	Federal Department of Transport

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ABBREVIATIONS

ABS	Australian Bureau of Statistics
AGPS	Australian Government Publishing Service
ACT	Australian Capital Territory
ATFCC	Australian Transport Freight Commodity Classification
BHAS	Broken Hill Associated Smelters Pty Ltd
BMR	Bureau of Mineral Resources, Geology and Geophysics
BTE	Federal Bureau of Transport Economics
DoT	Federal Department of Transport
MD	Mining District
NATMAP	Division of National Mapping, Department of Resources and Energy
NSW	New South Wales
NT	Northern Territory
PACM	Port Authority Cargo Movements
Qld	Queensland
SA	South Australia
SACCS	Shipping and Air Cargo Commodity Statistics
SEC	State Electricity Commission
Tas	Tasmania
Vic	Victoria
WA	Western Australia