

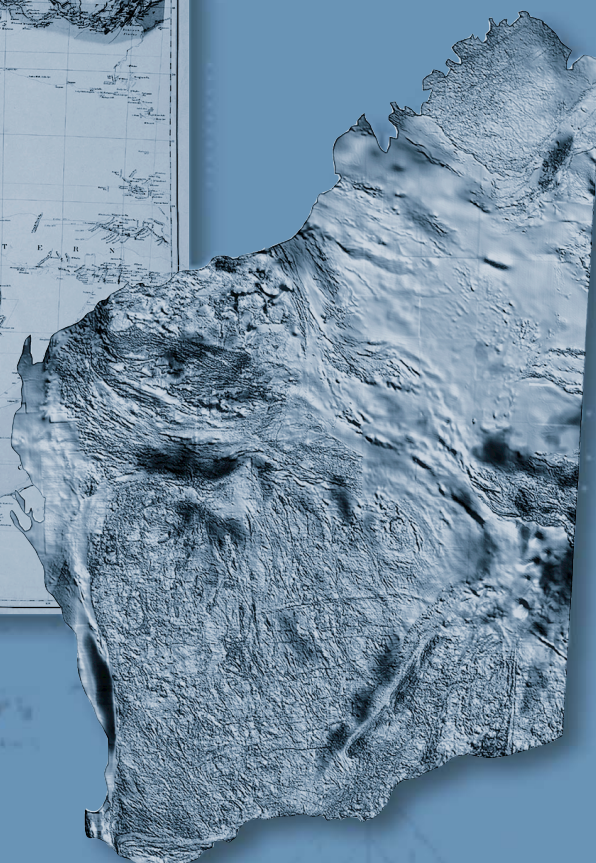
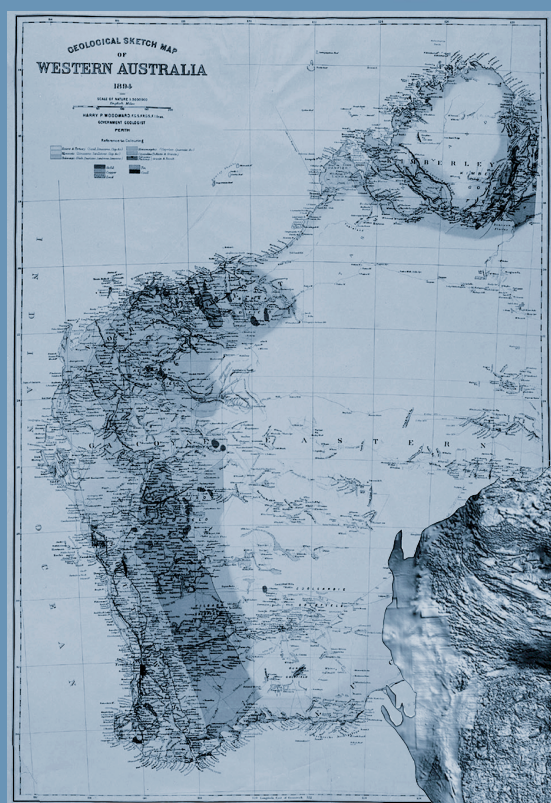


Department of
Mineral and Petroleum Resources

**RECORD
2002/19**

MINES AND MINERAL DEPOSITS OF WESTERN AUSTRALIA digital extract from MINEDEX — an explanatory note, 2002 update

by R. W. Cooper, D. J. Flint, and S. M. Searston



Geological Survey of Western Australia



GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

RECORD 2002/19

MINES AND MINERAL DEPOSITS OF WESTERN AUSTRALIA: DIGITAL EXTRACT FROM MINEDEX — AN EXPLANATORY NOTE, 2002 UPDATE

by

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This Record is dedicated to David Townsend, a long-term custodian of MINEDEX within MPR, who passed away in 2002

Perth 2002

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Mines and mineral deposits of Western Australia: digital extract from MINEDEX — an explanatory note, 2002 update

by

R. W. Cooper¹, D. J. Flint¹, and S. M. Searston²

Abstract

This Record with digital extract provides an update for the locations and estimated mineral resources and ore reserves of all mines and mineral deposits in Western Australia. Locations for all historic mine sites (for all commodities) are also included, together with historic (pre-1985) gold and silver production figures. The released dataset contains selected information on 18 340 sites, of which 14 249 are mines and 2591 are deposits, with the remainder consisting of processing plants, tailings storage facilities, exploration sites, transportation sites, and handling facilities. A total of 1071 sites, mainly mines and associated processing plants, are classed as operating.

This detailed package of data is of value to geoscientists, mineral exploration and mining companies, government agencies, and academic institutions for project generation, evaluation of mineral potential, strategic planning, and map production.

KEYWORDS: Mines, mineral deposits, mineral resources, ore reserves, mineral production, mineralization, mining, digital data, data processing, computer applications, MINEDEX, Western Australia.

Introduction

MINEDEX is a textual database of mines and mineral deposits in Western Australia, providing:

- an authoritative list of all mineral projects, mines, and mineral deposits;
- accurate point locations of mines, deposits, and processing plants;
- details on the stage of development and operating status of mines;
- contact details for mine operators;
- a listing of all Notices of Intent (NOIs) to commence or vary mining activities;
- an inventory of ore resources and reserves for all commodities in Western Australia;
- some production data, principally pre-1985 gold production data;
- project owners and their percentage holding;

- a logical data model for mining industry information maintained by the Department of Mineral and Petroleum Resources (MPR). Such information, commonly in other databases, is linked to the core components (projects and sites) of MINEDEX. Some examples are accident statistics and mine site employment (AXTAT system), air sampling at mine sites (CONTAM system), annual environmental reports (AER system), site inspections by environmental and safety inspectors, and records administration within MPR.

The MINEDEX database is unique in its extensive and authoritative State-wide coverage of mine sites and deposits, their coordinates, operational status, and compilation of mineral resource estimates. Both open-file and confidential data are maintained within the system, but only the open-file portions are available to the public.

The data have been obtained from a variety of sources, including stock exchange reports, newspaper and periodical articles, published technical papers, statutory exploration reports, and other correspondence submitted to MPR. The largest source of information is reports to the Australian Stock Exchange (ASX).

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This Record is one of a range of methods by which data from MINEDEX are released to the public. It provides a guide to this specific set of data, including highlighting the changes to the system since the last information note (GSWA Record 2000/13) was released (Townsend et al., 2000).

MINEDEX conceptual model

The MINEDEX database is established around a core of projects and sites, and contains information on:

- project ownership (corporate);
- commodity group (major mineral or group of minerals);
- site type and development status;
- locality data (coordinates and map sheets);
- mineral resource estimates;
- notice of intent to mine/develop;
- mine operators and contact addresses;
- tenements;
- production statistics.

Sites, to which most attributes relate, are the core of the MINEDEX system. The relationships between the key elements of MINEDEX are shown in Figure 1.

Uses of MINEDEX

The following are examples of how MINEDEX data are used by MPR's internal and external customers:

- Mines and deposits are plotted on all Geological Survey of Western Australia (GSWA) maps as a basic element of the maps, including digital products, both on CD and web-based (e.g. GeoVIEW.WA).

- Mineral resource information is included in GSWA Explanatory Notes to maps and other publications.
- Some of the data are widely used as measures of the geological prospectivity of regions. Examples of this include the spatial distribution of mines and deposits, recorded mineral production, current resource estimates, and pre-mining resources.
- The mineral resources inventory for the State is used as a 'Key Performance Indicator' of MPR's activity in encouraging exploration and development of the State's resources.
- The data are routinely requested by State government agencies involved with planning and regional studies, including MPR. For such organisations, the availability of MINEDEX eliminates their need to maintain such data. Within MPR, the data are used in land-alienation assessments and in Commonwealth–State–Industry 'Regional Mineral Studies'.
- MINEDEX data are routinely used by commodity specialists from other organizations when they require an authoritative source of information.
- The preparation of tenders, such as 'due diligence', takeover target, and joint venture evaluations, uses features such as the rapid assessment of all mines and deposits held by the target company, project ownership and cross-holdings, and the reference to the source of the mineral resource estimates.
- Mines and deposits are plotted in MPR's electronic tenement-graphics system, TENGRAPH, hence the latest information on tenements and tenement holder is available. In addition, MINEDEX can be used to locate mineral deposits with 'No current owner'.

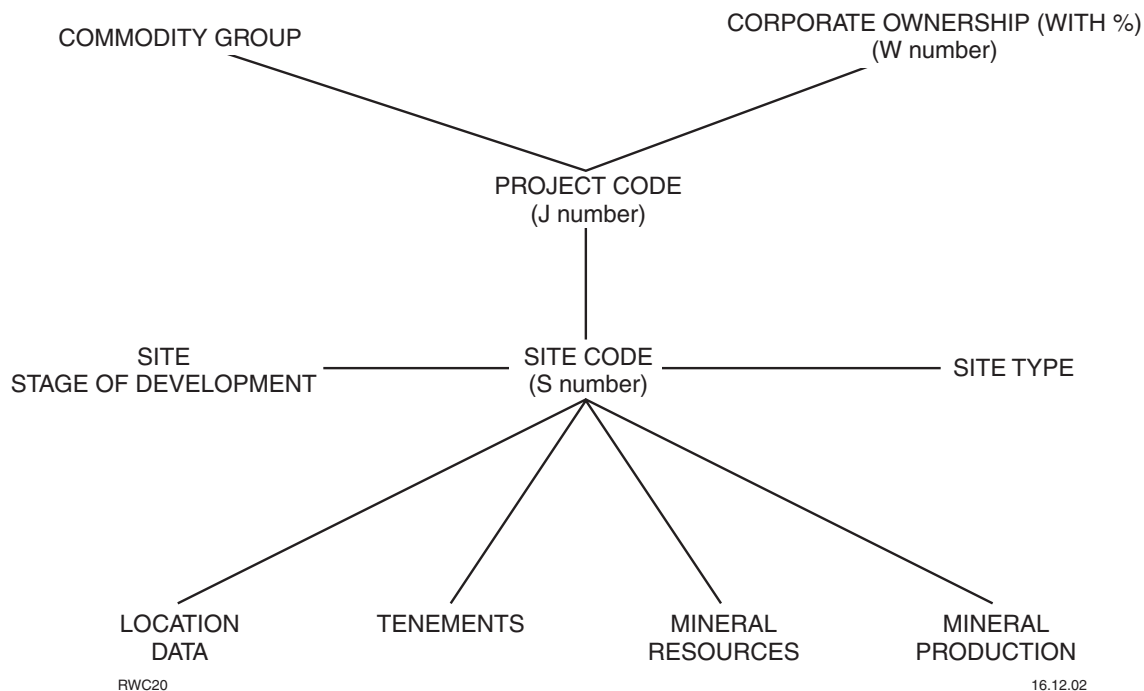


Figure 1. Simplified relationships between fields in MINEDEX

- The 'contact details for site operators' feature is regularly used by groups such as job seekers and service companies.
- MPR licenses companies to use the open-file data on their websites.
- The NOI system provides an 'early warning system', allowing industry and the public to monitor all mining proposals submitted to MPR.

MINEDEX is used within MPR as an administrative tool for sections of the Mining Act 1978 and Mines Safety and Inspection Act 1994 (and related Regulations).

MINEDEX data releases

MINEDEX data can be viewed by a variety of means, but the same information is not necessarily accessed in each case.

At present the available methods for accessing MINEDEX data include:

- periodic downloads on to a CD released by GSWA (Townsend et al., 1996, 2000). The digital data accompanying these GSWA Records were updated once or twice per year.
- via MINEDEX on the web (www.mpr.wa.gov.au/minedex2). The web front end is only a partial view of MINEDEX, which is refreshed nightly. Digital downloads of the data will soon be possible.
- via MPR's GeoVIEW.WA (an integrated GIS package) on the web (www.mpr.wa.gov.au/geology/), with sites displayed in their geological context. Again, this is only a partial view of the MINEDEX data, but with nightly updates. Digital downloads of the data displayed are not possible (except as plotted maps).
- via MPR's TENGRAPH system (www.mpr.wa.gov.au/prodserv/remote/tengraph). Sites are displayed in their tenement and cadastral context in TENGRAPH, but only very limited site information is available. Digital downloads of the data are not possible (except as plotted maps).
- via direct querying of the data stored on the mainframe (only available to internal users).
- as specific requests on resource-related topics to MINEDEX data custodians in the Mineral Resource Information Branch (MRI), Investment Attraction Division of MPR.
- via the websites of companies with non-exclusive licenses to use MINEDEX data, for example, Intierra Pty Ltd (www.intierra.com), but its system only provides access to subscribers.

The future trend for extracting and reporting of MINEDEX data will be the use of MPR's recently acquired COGNOS software, allowing the external user to perform web-based queries and download the output.

MINEDEX data custodians

The data custodians of MINEDEX are staff from various divisions of MPR, including:

- The Mineral Resource Information Branch of the Investment Attraction Division, who are responsible for:
 - maintaining the integrity of the core components, which comprise projects, project ownership, commodity groups, sites, site coordinates, site stage of development, site operating status, and tenement coverage over deposits;
 - maintaining the mineral resource inventory;
 - endeavouring to increase the coverage of mineral production data.
- The Safety, Health and Environment Division (SHED, formerly the Mining Operations Division), who maintain components used for the monitoring of NOIs, AERs, site operators (names and addresses), accident statistics, atmospheric contaminant sampling, and site and machinery inspections. Such data are either stored within MINEDEX (either partially or in full) or in other systems linked to the core components of MINEDEX.

Feedback on MINEDEX can be directed using 'contact us' in the MINEDEX help screens on MPR's website (www.mpr.wa.gov.au/minedex2), or by contacting Don Flint, ph. (08) 9327 5962, fax (08) 9222 3862; or Roger Cooper, ph. (08) 9327 5449.

Changes to MINEDEX since GSWA Record 2000/13

Significant changes to MINEDEX since the last information note (GSWA Record 2000/13) was released in 2000 include:

- The Joint Ore Reserves Committee of the Australasian Institute of Mining and Metallurgy, Australian Institute of Geoscientists, and Minerals Council of Australia (JORC) terminology for mineral resources and ore reserves (JORC, 1999) was adopted. All estimates of resources stored in MINEDEX that pre-date the 1999 edition of the JORC code have been converted to what is considered the most appropriate equivalent classification.
- Additional commodity groups were created, with associated minerals. These mostly relate to the non-mineral sector of the industry and include the commodity groups 'chemicals' and 'petrochemicals', with related specific minerals (commodities) within those commodity groups — such as methanol, dimethyl ether, ammonia, and urea.
- The new 'proposed' stage of development was added at project and site level.
- Additional site types were created — 'tailings storage facilities' and 'power plants'.
- All coordinates were converted to the Geodetic Datum of Australia 1994 (GDA94) using Map Grid Australia (MGA) coordinates.

MINEDEX data released on CD

Data coverage

The data supplied on the accompanying CD, with italicized key names, are summarized below:

- MINEDEX *sites*, which include exploration sites, mineral deposits, mines, processing and power plants, associated mining infrastructure (e.g. handling sites), and cross-reference sites (alternative names);
- *group sites*;
- mining or potential mining *projects* (a combination of sites with a common commercial ownership that share, or would share, a common mining infrastructure);
- *commodity group* for each project;
- corporate *ownership* and percentage holding;
- *site type* and *stage* of development;
- *coordinates* (latitudes and longitudes, and MGA eastings and northings);
- *local government authorities* (LGAs);
- current estimates of *mineral resources* and *ore reserves*, with associated cutoff criteria;
- gold and silver *production* for pre-1985 gold mines;
- *tenements* for historic production sites.

The total number of records and the number of unique sites/values for each file are shown in Table 1. The data on the CD accompanying this Record (as at 5 December 2002) contains selected information on 18 340 sites, of which 11 411 are historic mines, 2838 are recent (post-1985) mines, and 2591 are deposits. The remainder are cross-reference sites, processing and power plants, transportation and handling facilities, and exploration sites. A total of 1071 sites, mostly mine sites, are classed as operating.

The CD accompanying this Record contains the above data structured into ten files:

- R2002_19.PDF — file containing this text (GSWA Record 2002/19);
- TABLES.DOC — a text file containing a copy of index and look-up tables is reproduced in this Record as Appendices 1, 2, and 3;
- MINEDEX2.MDB — an MS Access 97 database containing seven tables — SITES - COORDINATES, PROJECT - OWNER, RESOURCES, RESOURCE_CUT_OFF, PRE_1985_GOLD_PRODUCTION, HISTORIC_TENEMENTS and MINERALIZATION_TYPE. These contain the same data as the seven individual ASCII files described below:
 - SITECOOR.CSV — a comma-delimited text file containing data on sites, commodity groups, projects, and coordinates;
 - PRJOWN.CSV — a comma-delimited text file listing corporate ownership and percentage ownership;
 - RESOURCE.CSV — a comma-delimited text file containing resource figures;

- CUT_OFF.CSV — a comma-delimited text file containing resource cutoff criteria;
- HISTPROD.CSV — a comma-delimited text file containing pre-1985 tonnage of gold ore treated and gold and silver produced;
- HISTTEN.CSV — a comma-delimited text file containing historic tenements for historic production sites (pre-1985 for gold mines and pre-1989 for mines for all other commodities). The MINEDEX database does contain current and recent tenements for mines and deposits; these are not available on the CD, but can be viewed via MINEDEX on the web;
- MINTYPE.CSV — a comma-delimited text file containing style of mineralization for resources.

The data for these files can be linked by use of the project code (J number) or site code (S number), or both, as shown in Figure 2.

The database is fairly comprehensive (in terms of projects and sites) for developments from 1986 onwards for all mineral commodities, except for basic raw materials extracted from private land and petroleum. This is synonymous with the data being comprehensive for all quarries, mines, and proposed mines that are MPR's responsibility under the Mining Act 1978, Mines Safety and Inspection Act 1994, Mines Safety and Inspection Regulations 1995, and their predecessors. Basic raw materials (construction materials, sand, gravel, etc.) on private land are not defined as a mineral in the Mining Act 1978, hence there are no reporting requirements to MPR, and this section of the database is incomplete.

Mining projects and sites that pre-date the introduction of MINEDEX in 1985 have been incorporated within MINEDEX, with 11 411 historic mine sites (MH) added. Currently some of the MH sites have coordinates related to the centroids of the cancelled gold mining leases (GMLs) against which production was recorded. No attempt has been made to modify the coordinates to match actual mining-related features derived from field-based (e.g. GSWA's inventory of abandoned mine sites or regional mapping projects) or office-based studies.

Table 1. Summary information on the numbers of records and unique sites/values in the MINEDEX data released (as at 5 December 2002)

Table subject	Number of records	Number of unique sites or values
Historic tenements	18 112	16 510
Pre-1985 gold production	12 090	9 493
Project owners	2 548	2 004 projects
Resources	12 387	2 781
Resources with cutoff criteria	2 814	1 238
Site coordinates	18 340	18 340

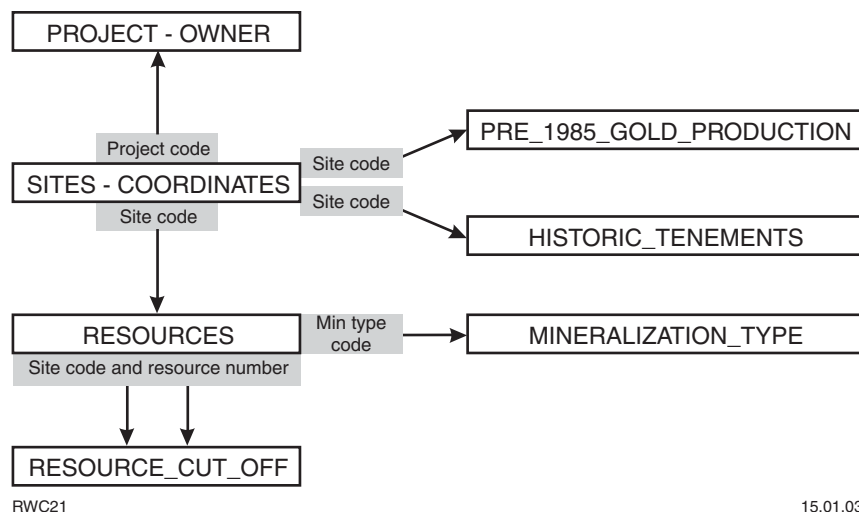


Figure 2. Key fields linking the MS Access tables and text files

Production statistics in MINEDEX for mine production since 1985 are not available to the public. Only pre-1985 gold production data are included on the accompanying CD. State-wide production statistics are available from 1997 onwards in the Statistics Digest on MPR's website.

MINEDEX is also an inventory of all estimated mineral resources and ore reserves, for all commodities except petroleum. This applies regardless of whether the site is a mine or a deposit.

Information on mineral resource estimates and locations acquired from confidential sources, such as statutory mineral exploration reports and other confidential reports submitted to MPR, is not available in this dataset. Where confidential data exist, the status column in the SITES - COORDINATES or RESOURCES tables (or equivalent SITECOOR.CSV and RESOURCE.CSV text files) is flagged with a 'C', and the fields for location or resources are left blank.

The coverage of exploration sites, where resources have not yet been estimated, is severely limited within MINEDEX; MPR's Western Australian mineral occurrence database (WAMIN) is designed as the main system for storing information on mineral occurrences. Exploration sites included within MINEDEX are generally restricted to high-profile recent discoveries where drillhole intercepts containing significant grades or thicknesses have been reported to the ASX, that is, sites at which it is likely that a resource estimate will be available in the not-too-distant future.

Sites

Sites, to which most attributes relate, are the core of the MINEDEX system. Each site is linked to a project and therefore to a commodity group and owners (see Fig. 1). The site code (S number) is the key unique identifier for each site.

The SITES - COORDINATES table/file is the major information table that can be used to directly generate a GIS plot in a suitable GIS package. An example of the table/file contents is shown in Table 2.

Site names

Care should be taken when using site names to avoid confusion. Problems arise because:

- site names in reality are not unique;
- different names are used through time for the same site;
- the current 'fashionable' name for the site may not match that currently used within MINEDEX;
- users query the site name data, but use a project name instead.

All sites created in the database since 1985 are forced to have unique names, although site names in reality are not unique. The most common form of non-unique names is with historic production sites. For these specific sites, the MINEDEX convention is to have a mineral field/district number appended to the name in order to make the name unique and to provide a quick guide to its location. This results in the name Day Dawn, for example, being represented by the separate records of Day Dawn (21), Day Dawn (25), Day Dawn (40), and Day Dawn (46).

To help overcome this perennial problem, MINEDEX also uses the concept of 'alternative name' as a site type, stored as 'cross reference' sites (see **Site type**).

Users are also advised that it is good practice, when searching names, to search on the chosen name (text string) using the software's facility, as in MS Access, to 'Find' that text string in 'Any part of the field'.

Table 2. Sample of contents of SITES - COORDINATES table/file

Commodity	Project	Project code ^(a)	Site	Site code ^(b)
BAUXITE-ALUMINA	JARRAHDAL-KEWINANA	J00777	KWINANA ALUMINA REFINERY	S01735
COAL	HILL RIVER-JURIEN	J00988	BRAZIER	S03672
COAL	HILL RIVER-JURIEN	J00988	WONGONDERRAH	S03674
COPPER-LEAD-ZINC	TRILOGY	J02252	TRILOGY	S06514
COPPER-LEAD-ZINC	ELVERDTON DUMPS	J02016	ELVERDTON DUMPS	S05322
COPPER-LEAD-ZINC	TEUTONIC BORE	J01287	TEUTONIC BORE DUMPS	S04275
COPPER-LEAD-ZINC	LENNARD SHELF	J00638	PILLARA	S01545
COPPER-LEAD-ZINC	LENNARD SHELF	J00638	BLENDALE	S01419
GOLD	BALAGUNDI / STOCKDALE	J02293	BULONG PROSPECTING	S16668
GOLD	DARLOT	J00082	DARLOT PIT	S02876
GOLD	DARLOT	J00082	FILBANDIT	S01015
GOLD	DARLOT	J00082	MONTE CRISTO	S01115
GOLD	DARLOT	J00082	ZANGBAR	S01116
GOLD	BIG BELL	J00017	GOLDEN CROWN PLANT SITE	S05682
GOLD	HISTORIC-GOLD-IN-TENGRAP	J02334	MADAM BERRY	S07749
GOLD	YILGARN STAR	J01273	YILGARN STAR	S02852
HEAVY MINERAL SANDS	IRWIN	J02289	IRWIN HMS	S06649
HEAVY MINERAL SANDS	METRICUP	J02018	METRICUP	S05331
IRON ORE	HAMERSLEY	J00534	DAMPIER PORT OPERATIONS/HI	S01266
IRON ORE	HAMERSLEY	J00534	HAMERSLEY RAILWAY	S01596
MANGANESE ORE	SKULL SPRINGS	J00761	SKULL SPRINGS	S01678
NICKEL	KAMBALDA	J00551	LONG	S01301
NICKEL	KAMBALDA	J00551	LUNNON	S01302
NICKEL	MAGGIE HAYS-EMILY ANN	J01666	MAGGIE HAYS	S04369
NICKEL	MAGGIE HAYS-EMILY ANN	J01666	EMILY ANN	S06448
OTHER	HISTORIC-NON-GOLD- NOT- IN-TENGRAP	J02407	YINNIETHARRA BERYL / BURT	S18610
OTHER	HANNANS NORTH TOURIST MINE	J01349	HANNANS NORTH TOURIST MINE	S03201
OTHER	JANDAKOT PLANT / IMDEX	J00978	JANDAKOT PLANT / IMDEX	S02079
VANADIUM-TITANIUM	WINDIMURRA	J00793	CANEGRASS ZONE	S01767
VANADIUM-TITANIUM	WINDIMURRA	J00793	WINDIMURRA PLANT	S17115
NICKEL	MT KEITH / WMC	J00756	MT KEITH / WMC	S01667
TIN-TANTALUM-LITHIUM	GREENBUSHES	J00530	GREENBUSHES TAILINGS	S01732
URANIUM	YEELIRRIE	J00398	YEELIRRIE	S00986

NOTES: (a) The project code is a unique code to differentiate projects with the same or similar names and for linkages to other tables/files.
(b) The site code is a unique code to differentiate sites with the same or similar names and for linkages to other tables/files.
(c) 'Map_name' is the display name for the site when plotted on TENGRAP or other maps, rather than the name of a map sheet area.
(d) Type of site (see Table 3).
(e) Stage of development. There is no stage for deposits or for some plants — O = operating; S = shut down; C = care and maintenance; D = under development.
(f) Status of resource (published or confidential). Confidential resources are not available in this dataset — P = published; C = confidential.
(g) Accuracy of location data. When blank, the coordinates have not been verified by MPR staff.
(h) Group sites are a combination of sites within a project.

Site type

Site types are divided into nine main categories, two of which have been introduced since 2000. These are shown in Table 3.

'Historic mines' (MH) are those with reported gold production prior to 1985 or with production of any other commodity prior to 1989. But note that not all pre-1985 gold mines and pre-1989 mines of 'other commodities' are stored in MINEDEX as 'historic' mines; some mines may have been in continuous operation in the period 1980–90 and would be considered as part of the 'current' rather than 'historic' part of the database. The production data for small or sundry gold producers (i.e. annual production of less than 100 ounces) since 1985 are not yet in MINEDEX, but will be added progressively. Non-gold production data is not available at present, but efforts will be made in 2003 to update and validate this data.

Prospecting sites (ML or DL) are low-impact operations (or proposals) that disturb surface materials

only and normally do not extend into bedrock. These sites are typically operated by prospectors for short, intermittent periods and can often extend over a number of tenements in the area. Such low-impact mining includes dryblowing, processing of alluvial and eluvial material through a small mobile plant, scraping and metal detecting, and costeaning and trenching. The minimum criterion for these low-impact mine sites and deposits to be included as a site within MINEDEX is the submission to MPR of an NOI to mine. Prospecting or low-impact sites do not extend to include applications for the removal of excess tonnages from tenements for exploration purposes.

The site type 'tailings storage facilities' (TS) was created for safety and environmental reporting purposes. They currently have no coordinates and, therefore, do not appear in the database extract provided. Tailings storage facilities that have economic mineral grades and are currently mined or proposed to be mined are classified separately and included, as 'mine tailings'(MT), and 'deposit tailings'(DT) respectively.

Table 2. continued

Map_name ^(c)	Type ^(d)	Stage ^(e)	Stat ^(f)	Latitude (°S)	Longitude (°E)	MGA coordinates			Accu- racy ^(g)	Local Government Authority	Group site ^(h)
						Zone	Easting	Northing			
KWINANA AL	P	O	P	-32.19444	115.7769	50	384716.34	6437343.482	Y	KWINANA TOWN	—
BRAZIER	DB	—	P	-30.08667	115.2389	50	330279	6670292	Y	COOROW SHIRE	—
WONGONDERRAH	DB	—	P	-30.53362	115.2675	50	333793	6620795	Y	DANDARAGAN SHIRE	—
TRILOGY	EX	—	P	-33.75583	120.2069	51	241300	6261400	—	NO SHIRE NAME GIVEN	—
Elverdton	MT	O	P	-33.627	120.1462	51	235269.14	6275534.587	Y	NO SHIRE NAME GIVEN	—
TEUTONIC BORE	DT	—	P	-28.41026	121.1464	51	318423.969	6855940.687	Y	LEONORA SHIRE	—
PILLARA	MU	O	P	-18.3237	125.7732	51	793132.296	7971761.697	Y	DERBY-WEST KIMBERLEY SHIRE	—
BLENDALE	X	—	P	0	0	0	0	0	—	DERBY-WEST KIMBERLEY SHIRE	—
PROSPECTING	ML	O	P	-30.73804	121.7894	51	384113.722	6598790.29	Y	NO SHIRE NAME GIVEN	—
DARLOT	MO	S	P	-27.88887	121.2675	51	329466.658	6913889.326	Y	LEONORA SHIRE	X
FILBANDIT	X	—	P	-27.89528	121.27	51	329723	6913185	—	LEONORA SHIRE	—
MONTE CRISTO	X	—	P	-27.89166	121.2667	51	329389	6913580	—	LEONORA SHIRE	—
ZANGBAR	X	—	P	-27.89166	121.2667	51	329389	6913580	—	LEONORA SHIRE	—
GOLDEN CROWN	P	S	P	-27.46693	117.8511	50	584093.03	6961545.478	—	NO SHIRE NAME GIVEN	G
MADAM BERRY	MH	S	P	-30.70404	120.9201	51	300808.215	6601338.728	Y	NO SHIRE NAME GIVEN	—
YILGARN STAR	MB	O	P	-31.53444	119.6772	50	754190	6508046	Y	YILGARN SHIRE	X
IRWIN	DO	—	C	—	—	—	—	—	Y	IRWIN SHIRE	—
METRICUP	DO	—	C	—	—	—	—	—	Y	NO SHIRE NAME GIVEN	—
DAMPIER	H	O	P	-20.67473	116.6997	50	468725	7713814	—	ROEBOURNE SHIRE	G
HAMERSLEY RLY	T	O	P	0	0	0	0	0	—	NO SHIRE NAME GIVEN	—
SKULL SPRINGS	DO	—	P	-21.86664	120.9833	51	291610.702	7580557.857	Y	EAST PILBARA SHIRE	—
LONG	MU	O	P	-31.17984	121.6761	51	373840	6549700	Y	KALGOORLIE-BOULDER CITY	—
LUNNON	MU	C	P	-31.20868	121.6727	51	373560.291	6546499.894	Y	COOLGARDIE SHIRE	—
MAGGIE HAYS	DU	—	P	-32.23694	120.5022	51	264646.131	6430551.045	Y	DUNDAS SHIRE	—
EMILY ANN	DU	—	P	-32.20351	120.4809	51	262548.987	6434210.019	Y	NO SHIRE NAME GIVEN	—
YINNIETHARRA	MH	S	P	-24.825	116.2291	50	422101.233	7254200.35	—	NO SHIRE NAME GIVEN	—
BERYL											
HANNANS N	MU	O	P	-30.72919	121.4691	51	353435.575	6599397.374	Y	NO SHIRE NAME GIVEN	—
JANDAKOT	P	O	P	-32.12138	115.8425	50	390808.457	6445510.886	Y	COCKBURN CITY	—
CANEGRASS	X	—	P	0	0	0	0	0	—	NO SHIRE NAME GIVEN	—
WINDIMURRA	P	D	P	-28.29332	118.5331	50	650330	6869333	Y	MOUNT MAGNET SHIRE	—
PLANT											
MT KEITH	MO	O	P	-27.23138	120.5447	51	256855.407	6985541.143	Y	WILUNA SHIRE	—
GREENBUSHES	MT	S	P	-33.87639	116.0619	50	413244.697	6251140.787	Y	BRIDGETOWN-GREENBUSHES SHIRE	—
YEELIRRIE	DO	—	P	-27.18361	119.9031	50	787631	6989887	Y	WILUNA SHIRE	—

The ‘handling facility’ (H) and ‘transportation system’ (T) site types include sites not necessarily for the handling or transporting of mine products. Typical mine-related examples are the railway systems and associated ship-loading facilities of the Pilbara iron ore industry. Recently added non-mine-related examples are general-purpose ports (handling facility) such as Geraldton, and irrigation systems (transportation system) such as the Ord Irrigation Stage 1. Such non-mine-related sites are shown on MPR’s annual Major Resource Projects map (MPR, 2002).

The ‘cross reference or alternative name’ (X) site type is essentially a synonym or cross reference name for a deposit, mine, plant, transportation system, handling facility, or exploration site. For example, the Blendvale site is shown as a synonym because it was the previous name for the Pillara underground mine. In some cases, mines are combined to form a single new mine — an example is the Filbandit, Monte Cristo, and Zangbar pits that are now part of the Darlot pit. The pre-existing mines are classified as ‘alternative name’ sites, whereas the existing site (Darlot openpit) is both a ‘mine’ site type individually as well as being an ‘X’ group site (see **Group sites**).

‘Exploration’ sites (EX) are a relatively recent addition to MINEDEX. There are no minimum requirements for

these sites to be added to MINEDEX, and there is certainly no attempt to provide comprehensive coverage of exploration sites or mineral occurrences. Exploration sites included in MINEDEX are restricted to the high-profile recent discoveries at which resources have not yet been estimated, but where a resource estimate is likely in the not-too-distant future. As resources are estimated and announced, such ‘exploration’ sites are given ‘deposit’ status. Examples of these in recent years are Trilogy, Thunderbox, and Waugh. Exploration sites have been included in this dataset. More extensive information on mineral occurrences can be found in the WAMIN database released by GSWA in the form of maps and digital data packages.

A second style of exploration sites in MINEDEX are those sites, away from existing mining operations, at which accidents have been reported to MPR. Here the projects and sites information is stored in MINEDEX, but the related accident information is stored in another linked MPR system — AXTAT.

Site stage of development

All sites, except deposits, exploration, and alternative names, can have a stage of development of either (Table 2)

Table 3. Site types in MINEDEX

<i>Site type</i>	<i>Code</i>
Deposit (those non-mine sites at which there may be a mineral resource estimate)	
Deposit low impact (prospecting)	DL
Deposit openpit	DO
Deposit underground	DU
Deposit both (underground and openpit)	DB
Deposit tailings (tailings and/or dumps retreatment)	DT
Mine (not all mines will have mineral resource or ore reserve estimates)	
Mine low impact (prospecting)	ML
Mine openpit	MO
Mine underground	MU
Mine both (underground and openpit)	MB
Mine tailings (tailings and/or dumps retreatment)	MT
Mine historic	MH
Power plant (new since 2000 and not necessarily mine related)	PP
Processing plant	P
Tailings storage facility (new since 2000)	TS
Handling facility (mostly port operations)	H
Transportation system (mostly haul roads and railways)	T
Cross reference or alternative name (synonym)	X
Exploration site (without resource estimates)	EX

proposed (P), under development (D), operating (O), care and maintenance (C), or shut down (S). The ‘proposed’ stage has been added since the last information note was produced in 2000 (Townsend et al., 2000).

Site coordinates

Coordinates are provided in two formats (Table 2):

- latitude/longitude in decimal degrees;
- metric MGA coordinates using the GDA94 datum. This system, introduced during 2000, replaces the old Australian Map Grid (AMG) coordinates that were based on the Australian Geodetic Datum (AGD84).

In addition:

- MINEDEX sites are represented as point data even though on the ground the site usually represents a feature better recorded as a polygon.
- The coordinates for a site are located, where possible, in the centre of an identifiable surface expression of that site, as in the centroid of an openpit. However, the coordinates may not necessarily lie over the exact surface projection of an underground orebody, where the portal of an underground decline or a headframe may be chosen. Similarly, for a deposit or exploration site, drillhole collar coordinates may be selected in the early stages of reporting.
- A ‘Y’ in the accuracy column (Table 2) indicates that the site is displayed in TENGRAPH, with internal

business rules dictating that only sufficiently accurate MINEDEX sites are promoted to TENGRAPH. Although deemed ‘accurate’ at the time of promotion into TENGRAPH, the coordinates are modified when detailed site-location information is received. Exploration sites are currently not displayed in TENGRAPH.

- A logical extension of the above point is that this dataset on the accompanying CD may contain sites that are not displayed in TENGRAPH. Conversely, TENGRAPH may contain other points and improved locations of existing points because corrections to sites in MINEDEX are more promptly picked up by TENGRAPH, whereas the CD accompanying this Record is only updated once or twice per year.
- If users need to check the most recent coordinates for a site, then checking MINEDEX (or the MINEDEX theme in GeoVIEW.WA) on MPR’s website is the best method. Data on the web is refreshed from the mainframe version of MINEDEX each night.

Group sites

MINEDEX uses the concept of ‘group’ site as it is often preferable for a variety of reasons to handle data at group level rather than for every site within the group (Table 2). Commonly encountered examples are estimates of mineral resources and recorded mineral production, provided to MPR or to the public, that only quote the information for a group of sites or for the whole project, rather than separate resource or production data for each and every site. Such group information is modelled and handled within MINEDEX at site level by use of group sites, although, conceptually, group sites are somewhat intermediate between projects and sites.

Examples of instances where group sites have been used are:

- ‘X’ group sites — for example, in the Darlot gold project, the Darlot pit is labelled as a group site since the separate Filbandit, Monte Cristo, and Zangbar pits merged into a single pit (Table 2);
- ‘G’ group sites —
 - In the Kambalda nickel project, which has around 70 sites, the project’s owners report mineral resources and production to their shareholders as totals for the project, not by individual deposit or mine. Thus a group site was generated in MINEDEX to accommodate these data under the single Kambalda Group. Furthermore, because this project is so extensive, additional subgroups, based on geographical location, are used in MINEDEX for data monitoring.
 - Stockpiles reported in ore reserve or mineral resource statements are attached to the ‘G’ group site because the origin of the ore is not stated.
 - ‘G’ group sites are also created for reporting purposes, in order to record project-level annual environment reports processed by the Safety, Health, and Environment Division of MPR.

Projects

Projects, to which some attributes relate, are another core component of the MINEDEX system. Commodity group and corporate owners are linked at project level (Fig. 1). The project code (J number) is the key unique identifier for each project.

Projects in MINEDEX are defined as a combination of sites with common commercial ownership that are grouped together in an integrated operation. An example is the Hamersley project containing 20 mines, 51 deposits, three processing plants, one power plant, three tailings storage facilities, three alternative name sites, two exploration sites, three port handling facilities, and a 300–400 km transportation route (Hamersley railway). These are all owned by Hamersley Iron Pty Ltd, a subsidiary of Rio Tinto Ltd, and are an integral part of the process from mining to shipping the iron ore overseas. Unlike major iron ore projects, which have a very large aerial extent, most projects are much smaller.

There are four special projects that do not meet the above criteria; these projects were generated for the initial capture of the locations and production data of historic mines, but will eventually be deleted when all these sites are distributed to other projects. The four projects are 'Historic gold in TENGRAPH', 'Historic gold not in TENGRAPH', 'Historic non gold in TENGRAPH', and 'Historic non gold not in TENGRAPH'. These projects contain all historic mines.

Projects that consist entirely of sites involved with downstream processing have been added to the database in 2002. Typical of these projects are the chemical and petrochemical industries proposed for the Burrup

Peninsula. This has facilitated more efficient production of MPR products, for example, the Major Resource Projects map (MPR, 2002).

Because the Major Resource Projects map includes potential projects, an additional category of project status of 'proposed' (P) was established in MINEDEX in 2002. Before 2002, only 'active' (A) and 'inactive' (I) categories existed.

Project owners

Project ownership should not be confused with the different concepts of project operator and tenement holder. Project operator relates to mining projects where the operator is a contract mining company, and hence may be different to the project owner.

For each project an attempt is made to maintain the current project owners and the percentage held by each owner. Only the current project owners are included in the dataset released on CD, but previous owners and the date range for ownership are stored in MINEDEX on MPR's mainframe. Typical examples of the PROJECT - OWNER table/file are shown in Table 4.

Project ownership is constantly changing with complex joint ventures and farm-in arrangements, with the ownership percentages changing (or proposed to change) as various milestones are reached. This parameter is difficult to monitor with a high degree of accuracy from public documents. The MPR policy, for the purposes of MINEDEX, is to regard the percentage owned to be what the joint venture or farm-in partners state they are proposing to earn up to, or dilute down to. This simplifies

Table 4. Sample of contents of PROJECT - OWNER table/file

<i>Project code^(a)</i>	<i>Project</i>	<i>Percentage^(b) owned</i>	<i>Owner</i>
J00480	MURRIN MURRIN - CENTRAL BORE	60	ANACONDA NICKEL NL
J00480	MURRIN MURRIN - CENTRAL BORE	40	GLENCORE INTERNATIONAL AG
J02291	MURRIN MURRIN - WINDARRA	100	ANACONDA NICKEL NL
J00026	BODDINGTON - HEDGES	44.444	NORMANDY MINING LTD
J00026	BODDINGTON - HEDGES	33.33	ANGLOGOLD LTD
J00026	BODDINGTON - HEDGES	22.222	NEWCREST MINING LTD
J00275	NEVORIA	25	COEUR D'ALENE MINES CORP
J00275	NEVORIA	–	ECLIPSE RIDGE PTY LTD
J00275	NEVORIA	75	SONS OF GWALIA LTD
J01527	NEW BELLEVUE	–	MOUNTFORD NORMAN LESTER
J01527	NEW BELLEVUE	100	CHITTY CHARLES GEORGE
J00177	KALTAILS	90	NORMANDY MINING LTD
J00177	KALTAILS	10	GOLD CORPORATION
J00751	TALLERING PEAK - MID-WEST IRON AND STEEL	100	KINGSTREAM STEEL LTD
J01328	PANORAMA	60	MINCOR RESOURCES NL
J01328	PANORAMA	40	SIPA RESOURCES LTD
J00009	DUKETON	37.5	NORMANDY MINING LTD
J00009	DUKETON	37.5	JOHNSONS WELL MINING NL
J00009	DUKETON	25	DUKETON GOLDFIELDS LTD
J00009	DUKETON	–	RAMSGATE RESOURCES LTD
J00010	BANNOCKBURN	100	N M ROTHSCHILD AUSTRALIA HOLDINGS PTY LTD

NOTES: (a) The project code for linking owners to projects in the MS Access SITES - COORDINATES table and SITECOORD.CSV file.
(b) If percentage owned is unknown, this field is blank.

maintenance of the data in the database and avoids frequent updates of minor changes in project ownership, which are commonly poorly or incompletely reported.

Other data entry protocols include:

- if a partner withdraws from a joint venture, the percentage owned reverts to the other part owner(s);
- inactive or active projects, where all owners have withdrawn, revert to 'no current owner' with ownership holding set at 100%;
- projects made inactive because they have been merged into a larger project retain the percentage ownerships at the closing merge date.

Wherever possible, percentage ownership is entered, but some examples where 'X' is placed in the 'not known' field are when:

- an owner has a significant holding in a project, but the holding percentage is not exactly known or determinable from public documents;
- an owner receives a royalty only;
- an owner/pro prospector only has a percentage interest in part of the project (due to amalgamation of a number of projects);
- previously a prospector with a low-impact project on another company's ground was recorded as 'X'. The new policy is to create a new project and give the prospector(s) 100% ownership of the project.

Hence, it is important to note that the information on project ownership should be regarded as indicative only.

Commodity groups and minerals

A commodity group is a major mineral or combination of minerals, such as 'copper-lead-zinc', where the minerals typically occur together. Each project is linked to only one commodity group (but one commodity group can have many associated projects). Minerals have been attached to commodity groups for the purposes of resource estimates and production figures. A mineral may appear in more than one commodity group. MINEDEX contains 47 commodity groups, plus a catch-all category of 'others' (see Appendix 1).

The commodity group 'nickel' includes not only nickel, but can include copper, cobalt, platinum group elements, and gold as byproducts. Some commodity groups have sites and minerals related to construction (sand, gravel) or mineral processing (calcrete, limestone as reagents) phases of a project. Other minerals that are ore contaminants, such as 'slimes' in 'heavy mineral sands', are also included because these contaminants are commonly quoted in ore reserve statements.

The 'others' commodity group was created for special cases where no ore is produced or for a project that cannot be allocated to a single commodity group. Examples include such items as tourist mines, gas pipelines, ports, power plants, and non-specific mineral-processing plants. New commodity groups 'chemicals' and 'petrochemicals', with associated products, have been

added to further subdivide downstream processing plants. The chemical products of downstream processing have not been included in Appendix 1.

Commodity groups are updated to cover new mineralization associations, mineralization parameters, and mineral conversion factors as such data become available.

Mineral resources and ore reserves

MINEDEX resource and reserve terminology was altered in 2002 to reflect the reporting requirements adopted by the ASX (JORC, 1999). The JORC-derived relationship between mineral resources and ore reserves and the MINEDEX codes are shown in Figure 3.

The data provided are the current published mineral resource and ore reserve estimates for all mines and deposits throughout the State. A total of 12 387 resource/reserve records are contained on the CD, related to 2781 unique sites. However, like confidential locations, confidential resources have been deleted from the dataset released.

In essentially all cases no attempt has been made by GSWA to verify or check the resource estimates. Inclusion of a resource estimate within MINEDEX should not be taken as endorsement by MPR of the resource estimate. Some interpretation of the data originally presented by companies is necessary in circumstances where reporting of the resource estimate is old and pre-dates introduction of the JORC code, or where the JORC code has either not been used or followed only partially. Obviously, with time, and for both listed and unlisted companies, an increasing number of reported resource estimates will follow the JORC code. Examples of divergence from the JORC code are when some companies:

- do not separate resources and reserves and, in some cases, also quote measured plus indicated plus inferred resources as one figure;
- do not distinguish whether the estimates provided for mineral resources include or exclude the reserves.

The 'category' and 'status' fields use JORC terminology to record the levels of confidence of a resource/reserve estimate. Typical MINEDEX entries are shown in Table 5.

The 'source' field records the data source of the resource/reserve information identified as, for example, an ASX release, conference paper, or MPR briefing. The 'date' field is an attempt to record the date at which the estimation was completed, rather than the date the estimate was published. In the case of an ASX annual report, resources/reserves may be reported to 31 December 2000 although the annual report is only published in February 2001. In this way it is theoretically possible to use the data in conjunction with production data to calculate pre-mining resources, but this functionality is not currently available in MINEDEX. Appendix 2 lists many of the standard reference codes used in the database. Wherever possible company names are printed in full.

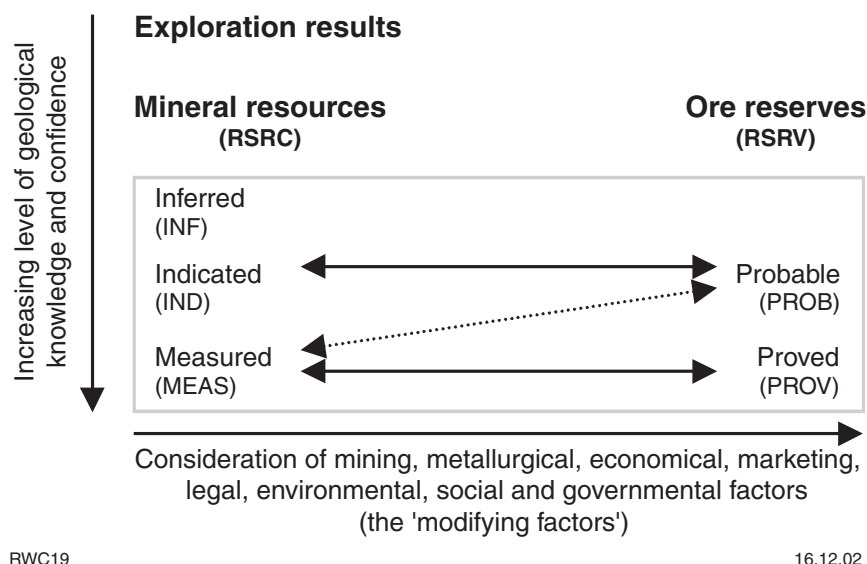


Figure 3. General relationship between exploration results, mineral resources, and ore reserves based on the JORC (1999) code. MINEDEX codes are indicated in brackets

Cutoff criteria have historically been under-reported, with only 2814 records related to 1238 unique sites. This low number of records is partially related to the number of resources that pre-date the JORC code, and partially to companies or individuals not strictly adhering to the code when reporting. Typical MINEDEX entries for the RESOURCE_CUT_OFF table/file is shown in Table 6.

Tonnes and grade

The 'tonnage' field (Table 5) has been set at millions of tonnes (Mt), but the mineral grade and contained metal/mineral units can vary according to the mineral. For each mineral a unique unit is used irrespective of the type of ore or commodity group with which it is associated. The contained metal/mineral is automatically calculated in MINEDEX using the ore tonnage and grade.

For all commodity groups, except one, the 'tonnage' recorded relates to mineable ore. The exception is heavy mineral sands (HMS) where the figure relates to tonnage of heavy minerals (HM) contained in the ore. The reason for this is that individual heavy minerals are expressed as percentages of the total heavy mineral suite. For example, for HMS a preliminary figure of 100.0 Mt at 1% HM has the resource entered in MINEDEX as 1.0 Mt of 100% HM 'grade'. The 'grade' in this case refers to the percentage of heavy minerals in the heavy mineral concentrate not the grade of the deposit (1%). If the percentage of ilmenite in the heavy mineral concentrate is 50% then the ilmenite resource is stated as 1.0 Mt at 50% ilmenite. In the CD extract the original grade of heavy minerals is not included. This figure can be sourced either on the MINEDEX mainframe or by returning to the original resource statement.

Totalling of resources

The 'in_total' field (Table 5) in the mainframe MINEDEX database is one of the key fields for using the resources in calculations. A 'Y' in the 'in_total' field or column indicates that the resource is to be used in calculating total resources for the project, region, State, or any other combination of sites. Estimates of mineral resources are not marked as 'in_total' when:

- the resource is included in another resource figure, either for the same site or for a group site within the project;
- the resource estimate has been superseded by a more recent estimate;
- the same resource has been stated at an alternative cutoff grade.

Flagging of resource estimates in this way avoids double counting in the instances where multiple figures are quoted at different cutoffs or where reserve figures are included within resource estimates.

If several resource estimates are published or released at the same time (e.g. with a range of cutoff criteria), the policy is to include all estimates in the main MINEDEX database, but make a subjective judgement as to which one should be marked as 'in_total'. If no estimate is apparently favoured by the author(s) of the report, then GSWA policy is to flag as 'in_total' the estimate with the cutoff that is closest to the current economic cutoff for that style of deposit. If economic conditions change and another cutoff criteria becomes more appropriate, the database is not re-examined or checked until the company releases a new resource estimate.

Table 5. Typical contents of RESOURCES table/file

Site	Site code	Res num ^(a)	Res cat ^(b)	Res type ^(c)	Min type ^(d)	Stat ^(e)	In total ^(f)	Tonnage (Mt)	Grade	Grade unit	Mineral	Cont metal ^(g)	Cont metal unit	Source ^(h)	Date ⁽ⁱ⁾
TELFER GROUP	S00717	7	PROB	RSRV	AUEPI	P	N	0.94	1.6	g/t	Au	1.504	t	AR NEWCR	30/06/95
TELFER GROUP	S00717	5	INF	RSRC	AUEPI	P	Y	5	0.76	g/t	Au	3.8	t	AR NEWCR	31/12/94
TELFER GROUP	S00717	3	PROV	RSRV	AUEPI	P	N	0.26	2.3	g/t	Au	0.598	t	AR NEWCR	31/12/93
TELFER GROUP	S00717	4	MEAS	RSRC	AUEPI	P	Y	0.02	2.3	g/t	Au	0.046	t	AR NEWCR	31/12/93
TELFER GROUP	S00717	8	PROV	RSRV	AUEPI	P	Y	5.8	0.83	g/t	Au	4.814	t	AR NEWCR	30/06/95
TELFER GROUP	S00717	6	IND	RSRC	AUEPI	P	Y	4.8	2	g/t	Au	9.6	t	AR NEWCR	31/12/94
SPEEWAH MAIN-ABC	S01902	3	IND	RSRC	FVEIN	P	Y	0.41	24.2	%	CaF ₂	0.099	Mt	PROSP EL	23/08/93
SPEEWAH MAIN-ABC	S01902	2	MEAS	RSRC	FVEIN	P	Y	1.87	25.8	%	CaF ₂	0.482	Mt	PROSP EL	23/08/93
SPEEWAH MAIN-ABC	S01902	1	INF	RSRC	FVEIN	P	Y	1.59	13	%	CaF ₂	0.207	Mt	PROSP EL	23/08/93
GREENBUSHES SPODUMENE	S01731	5	PROB	RSRV	SNPEGM	C	Y	—	—	—	—	—	—	—	—
GREENBUSHES SPODUMENE	S01731	4	MEAS	RSRC	SNPEGM	C	Y	—	—	—	—	—	—	—	—
MAC-PARALLEL RIDGE	S01615	1	MEAS	RSRC	FEMM	P	Y	38.9	6	%	LOI	2.334	Mt	A22483	31/12/87
MAC-PARALLEL RIDGE	S01615	1	MEAS	RSRC	FEMM	P	Y	38.9	61.8	%	Fe	24.04	Mt	A22483	31/12/87
MAC-PARALLEL RIDGE	S01615	1	MEAS	RSRC	FEMM	P	Y	38.9	1.52	%	Al ₂ O ₃	0.591	Mt	A22483	31/12/87
KINTYRE	S03154	1	IND	RSRC	UUNCF	P	N	5.333	1.5	kg/t	U ₃ O ₈	7.999	Kt	AR CRA	30/06/93
KINTYRE EAST	S03155	1	IND	RSRC	UUNCF	P	N	3.333	1.5	kg/t	U ₃ O ₈	4.999	Kt	AR CRA	30/06/93
KINTYRE GROUP	S00963	2	INF	RSRC	UUNCF	P	Y	7.333	1.5	kg/t	U ₃ O ₈	10.999	Kt	CRA BROCC	30/06/90
KINTYRE GROUP	S00963	1	IND	RSRC	UUNCF	P	Y	16	1.5	kg/t	U ₃ O ₈	24	Kt	CRA BROCC	30/06/90
NERADA	S03159	1	INF	RSRC	UUNCF	P	N	0.33	1.5	kg/t	U ₃ O ₈	0.495	Kt	CRA BROCC	30/06/90
PIONEER-KINTYRE	S03158	1	INF	RSRC	UUNCF	P	N	3.333	1.5	kg/t	U ₃ O ₈	4.999	Kt	AR CRA	30/06/93
WHALE	S03156	1	INF	RSRC	UUNCF	P	N	4	1.5	kg/t	U ₃ O ₈	6	Kt	AR CRA	30/06/93
WHALE EAST	S03157	1	IND	RSRC	UUNCF	P	N	7.33	1.5	kg/t	U ₃ O ₈	10.995	Kt	AR CRA	30/06/93

NOTE: (a) Res num is a computer-generated number to separate resources for a site.
(b) Resource category is either measured (MEAS), indicated (IND), or inferred (INF).
(c) Resource type is either mineral resources (RSRC) or ore reserves (RSRV).
(d) For full description of mineralization type (Min_type) see Appendix 3.
(e) Resource status (Stat) is either Confidential (C) or Published (P).

(f) In_total indicates whether the resource is included in the total resources for the region or State.
(g) Contained metal/mineral (Cont metal) calculated from tonnage × grade.
(h) Source of the resource figure (limit of 35 characters). For full description see Appendix 2.
(i) The date of the resource estimate rather than date of publication.

Table 6. Typical contents of RESOURCE_CUT_OFF table/file

Site	Site code	Res num	Mineral	Cutoff grade	Cutoff unit
RAVENSTHORPE 1	S02333	1	Ni	0.5	%
RAVENSTHORPE 1	S02333	2	Ni	0.5	%
RAVENSTHORPE 1	S02333	3	Ni	0.75	%
RAVENSTHORPE 1	S02333	4	Ni	0.75	%
RAVENSTHORPE 1	S02333	5	Ni	0.75	%
RAVENSTHORPE 1	S02333	6	Ni	1	%
RAVENSTHORPE 1	S02333	7	Ni	1	%
RAVENSTHORPE 1	S02333	8	Ni	0.5	%
RAVENSTHORPE 1	S02333	9	Ni	1	%
RAVENSTHORPE 4 SULPHIDE	S02334	3	Ni	0.75	%
EASTERN PEGMATITE	S02357	1	DEP.T	20	m
LEEKES	S02373	2	Au	0.5	g/t
LEEKES	S02373	2	WIDTH	2	m
HORSESHOE - FORTNUM	S02407	1	DEP.F	80	m
HORSESHOE - FORTNUM	S02407	1	DEP.T	115	m
CUMMINS RANGE	S02531	1	DEP.T	50	m
CUMMINS RANGE	S02531	1	REO	0.5	%
SIRDAR OPEN PIT	S03946	1	Au	0.5	g/t
SIRDAR OPEN PIT	S03946	1	RL.F	357	m
SIRDAR OPEN PIT	S03946	1	RL.T	242.5	m
PILLARA	S01545	11	Zn EQU	3	%
PILLARA	S01545	12	Zn EQU	5	%
GOLDEN HIND	S02179	1	Ni EQU	0.8	%
GOLDEN HIND	S02179	2	Ni EQU	0.8	%

NOTES: WIDTH Width of mineralization
Res num A computer generated number to separate resources for a site
DEP.F and DEP.T Depths (from and to) below surface of top and bottom of the resource calculation
RL.F and RL.T Relative levels (from and to) of top and bottom of the resource calculation
EQU Metal equivalent grade
REO Rare earth oxides

Some companies progressively update resource estimates for a specific site within a project, but provide no indication on how these figures change the earlier provided global resource estimate for a project. In such cases the earlier global resource estimate for the project is flagged as 'in_total', but the latest resource estimate for the one site is added to the database, but is not flagged as being in the State's total.

Where current confidential 'in_total' resources exist, the outdated published resource (if it exists) is retained in MINEDEX and marked as not being 'in_total' in order to give the user an idea of the tonnages and grade.

A policy to retain outdated (not 'in_total') resource estimates, over the last two years, will mean a gradual increase in the number of records stored in the tables. Retaining the old resource estimates will give temporal information on, for example, years in which resources were significantly increased or reduced. Previously, the old resource estimate was overwritten when a new resource estimate was received for the same site.

Mineralization type

The mineralization type (MINERALIZATION_TYPE) is included (when determinable from descriptions) in the RESOURCES table (Table 5). It is therefore possible to

determine, for example, State-wide total resources for a particular mineralization style. A complete list of the currently used mineralization types and their abbreviations is included as Appendix 3.

The basis of the mineralization classification is that adopted in Chapter 7 of the 'Geology and mineral resources of Western Australia' (GSWA, 1990). The abbreviated coding convention uses the first two or three letters to indicate the commodity group with which the mineralization type is associated, followed by three to four letters describing the style of mineralization.

However, not all resource estimates have been assigned a mineralization type at this stage. The coverage is high for most commodities other than gold.

Historic gold production and tenements

The PRE_1985_GOLD_PRODUCTION and HISTORIC_TENEMENTS tables and corresponding CSV files included on the CD contain historic (pre-1985) gold production and related historic tenements for all mines and deposits in the State. Production information since 1985 is held within the main MINEDEX database, but is partially confidential, hence is not released in this dataset.

The pre-1985 gold production information, including tenements, are derived from the list of cancelled gold mining leases (Department of Mines Western Australia, 1954) and the gold production records of 1954–85 held by MPR.

These data were entered into the GOLDSTAT database of W. R. Morgan, which MPR has acquired permission to publish.

Data on historic tenements are as recorded on the old production cards, and hence do not provide an exhaustive list of historic tenements for that site. Site names are also as recorded on the old production cards. Site names can be a mixture of poorly spelt mine names or mine operators, with the latter being either individuals or companies. Tenements are recorded as a ten-character field, comprising three characters for the tenement type, two characters for the mining district, and five characters for the tenement number. Examples of the tenement type are gold mining lease (GML), mineral claim (MC), dredging claim (DC), and private property (PP).

Production data are provided on a cumulative basis for each site, along with the period of production ('start_date' and 'end_date' fields). The product type and product code specifies whether it is normal gold ore or the less common cases of alluvial ore, dollied ore or tailings retreatment. The gold produced or contained within the final product is also listed, along with the units.

Summary

The digital data available with this Record provide current, readily accessible information on mineral resources and ore reserves, historic (pre-1985) gold production, spatial distribution, development status, deposit or mine types, mineralization type, and commercial ownership of projects. In the near future it is intended that the data in the digital extract forming part of this Record will be available as a download option on MPR's website. A PDF of the text of this Record will also be included.

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Appendix 1

Commodity groups and minerals

Commodity group	Order	Mineral	Mineral abbreviation	Commodity group	Order	Mineral	Mineral abbreviation
Alunite	10	Alunite	ALUM		20	Spongolite	SPONG
	20	Potash	K2O	Dimension stone	10	Dimension stone	DIM.ST
	30	Gypsum	CaSO4		20	Sandstone	SST
Andalusite–kyanite–sillimanite	10	Andalusite	AND		30	Quartzite	QZTE
					40	Limestone	LST
	20	Kyanite	KYAN		50	Black granite	B.GRAN
	30	Sillimanite	SILL		55	Granite	GRAN
Antimony	10	Antimony	Sb		60	Marble	MARBLE
Arsenic	10	Arsenic	As		70	Dolerite	DOLER
Asbestos	10	Asbestos	ASB		80	Slate	SLATE
	20	Chrysotile	CHRYST		90	Spongolite	SPONG
	30	Crocidolite	CROC		100	Jasper	JASPER
	40	Anthophyllite	ANPHYL	Dolomite	10	Dolomite	DOLOM
Barite	10	Barite	BaSO4		30	Dolomitic clay	DOLCLY
Bauxite–alumina	10	Alumina (product)	ABEA	Fluorite	10	Fluorite	CaF2
	20	Bauxite	BAUX		05	Emerald	EMER
	30	Aluminium	Al	Gem, semi-precious and ornamental stones	10	Amethyst	AMETH
	500	Reactive silica	RESIO2				
Bismuth	10	Bismuth	Bi		30	Opal	OPAL
Chemicals		Products only			32	Tourmaline	TOURM
Chromite–platinoids	10	Chromite	Cr2O3		35	Chrysoprase	CHRYSP
	20	Platinum	Pt		37	Malachite	MALACH
	25	Palladium	Pd		40	Tiger eye	T.EYE
	31	Rhodium	Rh		45	Jasper	JASPER
	40	PGE	PGE		50	Zebra rock	ZEBRA
	50	PGE + gold	PGEAu		60	Rose quartz	ROSEQZ
	55	Gold	Au		70	Agate	AGATE
	60	Nickel	Ni		80	Chalcedony	CHALCE
	70	Copper	Cu		90	Variscite	VARIS
	80	Chromium	Cr		100	Moss opal	M.OPAL
	100	Iron	Fe		110	Jarosite	Jaros
Clays	10	Attapulgit	ATTAP		140	Chert (green)	CHERT
	20	Bentonite	BENT	Gold	10	Gold	Au
	30	Kaolin	KAOLIN		20	Silver	Ag
	35	Saponite	SAPON		30	Copper	Cu
	37	Montmorillonite	MONT		40	Nickel	Ni
	40	Cement clay	C.CLAY		50	Cobalt	Co
	60	White clay	W.CLAY		54	Lead	Pb
Coal	10	Coal	COAL		55	Zinc	Zn
	20	Lignite	LIGN		60	Tungsten	WO3
Construction materials	10	Aggregate	AGGREG		70	Molybdenum	Mo
	20	Gravel	GRAVEL		500	Antimony	Sb
	30	Sand	SAND		510	Arsenic	As
	40	Rock	ROCK		994	Aggregate	AGGREG
	50	Soil	SOIL		996	Limestone	LST
	300	Vanadium	V2O5		997	Gravel	GRAVEL
	310	Titanium dioxide	TiO2		998	Sand	SAND
	320	Iron	Fe		999	Tungsten + Molybdenum	WO3Mo
Copper–lead–zinc	10	Zinc	Zn	Graphite	10	Graphite	GRAPH
	20	Copper	Cu		20	Carbon (fixed)	C
	30	Lead	Pb		10	Glaucanite	GLAUC
	40	Silver	Ag	Greensand	10	Gypsum	CaSO4
	50	Gold	Au		30	Alunite	ALUM
	52	Antimony	Sb		40	Dolomitic clay	DOLCLY
	55	Iron	Fe		500	Salt	SALT
	60	Molybdenum	Mo	Heavy mineral sands	10	Heavy minerals	HM
	65	Cobalt	Co		20	Ilmenite	ILM
	70	Barium	Ba		30	Leucoxene	LEUCO
	80	Cadmium	Cd		50	Rutile	RUTILE
	90	Tungsten	WO3		60	Zircon	ZIRCON
	999	Lead + Zinc	Pb+Zn		70	Monazite	MONAZ
Diamonds	10	Diamond	DIAM		80	Xenotime	XENO
Diatomite–spongolite	10	Diatomite	DIATOM				

Appendix 1 (continued)

Commodity group	Order	Mineral	Mineral abbreviation	Commodity group	Order	Mineral	Mineral abbreviation
Industrial pegmatite minerals	90	Garnet	GARNET	Peat	80	Power	POWER
	100	Kyanite	KYAN		10	Peat	PEAT
	110	Staurolite	Staur			Products only	
	130	Synthetic rutile	SYN.R		10	Phosphate	P2O5
	510	Slimes	SLIMES		20	Fe2O3 + Al2O3	R2O3
	520	Titanium dioxide	TiO2		10	Ochre	OCHRE
	530	Zirconia	ZrO2		20	Hematite pigment	HEM
	10	Mica	MICA		50	Iron	Fe
					10	Potash	K2O
					10	Sulfur	S
Iron ore	20	Beryl	BERYL	Pyrite-sulfur	20	Iron	Fe
	30	Feldspar	FELDS		30	Zinc	Zn
	31	Quartz	QUARTZ		40	Copper	Cu
	32	Beryllium oxide	BeO		50	Lead	Pb
	35	Alkalis	K+Na		10	Rare earth oxides	REO
	40	Alumina	Al2O3		20	Yttrium	Y2O3
	505	Ferric oxide	Fe2O3		25	Lanthanides	LnO
	10	Iron	Fe		30	Tantalite	Ta2O5
	20	Manganese	Mn		40	Columbite	Nb2O5
	500	Phosphorus	P		50	Tin (cassiterite)	SnO2
Limestone-limesand	510	Alumina	Al2O3	Rare earths	60	Xenotime	XENO
	520	Silica	SiO2		70	Gallium	Ga
	525	Sulfur	S		80	Zirconia	ZrO2
	530	Loss on ignition	LOI		90	Hafnium	HfO2
	10	Calcium carbonate	CaCO3		100	Beryl	BERYL
	20	Limestone-limesand	LIME		510	Alumina	Al2O3
	30	Limestone	LST		10	Salt	SALT
	40	Limesand	LSD		20	Gypsum	CaSO4
	50	Shell-grit	SHELL		997	Rock	ROCK
	95	Sand	SAND		998	Sand	SAND
Magnesite	100	Lime	CaO	Salt	10	Silica	SiO2
	160	Chalk	CHALK		20	Sand	SAND
	200	Magnesite	MgCO3		30	Quartzite	QZTE
	501	Silica	SiO2		510	Ferric oxide	Fe2O3
	10	Magnesite	MgCO3		520	Titanium dioxide	TiO2
	20	Magnesia	MgO		530	Alumina	Al2O3
	30	Magnesium	Mg		540	Heavy minerals	HM
	500	Silica	SiO2		10	Talc	TALC
	510	Lime	CaO		10	Tin (cassiterite)	SnO2
	10	Manganese	Mn		20	Tantalite	Ta2O5
Manganese ore	100	Iron	Fe	Silica – silica sand	30	Columbite	Nb2O5
	510	Silica	SiO2		40	Spodumene	Li2O
	520	Alumina	Al2O3		50	Kaolin	KAOLIN
	530	Phosphorus	P		60	Tantalite and columbite	TANCOL
	10	Nickel	Ni		70	Tin	Sn
	20	Copper	Cu		80	Spodumene concentrate	SPOD
	25	Cobalt	Co		510	Ferric oxide	Fe2O3
	30	Nickel + copper	Ni+Cu		10	Tungsten	WO3
	35	Nickel equivalent	Ni EQU		20	Molybdenum	Mo
	40	Gold	Au		30	Copper	Cu
Nickel	50	Platinum	Pt	Tungsten-molybdenum	40	Antimony	Sb
	55	Palladium	Pd		50	Vanadium	V2O5
	70	Chromite	Cr2O3		60	Gold	Au
	80	Silver	Ag		10	Uranium	U3O8
	90	Magnesia	MgO		20	Vanadium	V2O5
	500	Silica	SiO2		30	Copper	Cu
	995	Limestone	LST		10	Vanadium	V2O5
	996	Gravel	GRAVEL		20	Titanium dioxide	TiO2
	997	Sand	SAND		30	Iron	Fe
	998	Aggregate	AGGREG		40	Gold	Au
Other	10	Gold	Au	Uranium	50	Mica	MICA
	60	Timber	TIMBER		10	Vermiculite	VERMIC
	70	Water	H2O				

NOTES: This is a list of the available mineral-related 'commodity groups' in MINEDEX, but note that all of the above will not necessarily appear on the CD associated with sites and resources. Mineral order represents the sequence of relative importance within the specific commodity group. Contaminant or gangue minerals in potential products, and construction or process minerals have an order of 500 or greater. The MINEDEX system of mineral abbreviations is restricted to upper and lower case, without subscripts.

Appendix 2

Reference abbreviations for mineral resource estimates

<i>Source</i>	<i>Full title</i>
?	Unknown source/possible source
AER	Annual Environmental Report
AIM LSE	Alternative Investment Market, London Stock Exchange
AR	Annual Report
ASX	Australian Stock Exchange
ASX (USA) R 20F	Statutory report to New York Stock Exchange cc ASX
ASSOC.	Associated/Association
AUST.	Australia/Australian
AUSIMM	Australasian Institute of Mining and Metallurgy
BMR	Bureau of Mineral Resources
CORP.	Corporation
CORRES.	Company correspondence
CPR	Competent Persons Report
EMP	Environmental Management Report
ERMP	Environmental Review and Management Report
EX.	Exploration
GSWA	Geological Survey of Western Australia
INFO	Information
INTERN.	International
ITEM	Item number for statutory open-file report in MPR's Western Australian mineral exploration (WAMEX) database
M	Mines
MI	Mining
MIN	Mineral/Minerals
MPR	Department of Mineral and Petroleum Resources
NOI	Notice of Intent to mine
OPER.	Operations
P	Page
PERS. COMM.	Personal communication
PR	Progress Report
PT	Part
QR	Quarterly report
R	Report
WAMEX	MPR's Western Australian mineral exploration database of open-file statutory reports
WAMEX A	Open-file mineral exploration report in WAMEX database (A number)
WAMEX M	Open-file mineral exploration group reports in WAMEX database (M number)
WWW	Company website

NOTES: Company names and other sources are typed in full wherever possible, with abbreviations used only where the full reference is too long for the field limit of 35 characters.
Some resource estimates and their source are confidential; these do not appear on the CD.

Appendix 3

Mineralization types

Abbreviation	Mineralization type	Abbreviation	Mineralization type
ALLAKE	Alunite in lake sediments	FEBR	Iron ore deposits in the Brockman Iron Formation
ANDSED	Andalusite in metasedimentary rocks	FEGGT	Iron ore deposits in granite–greenstone terrains
ASBAMP	Metasomatic asbestos deposits in amphibolites	FEMM	Iron ore deposits in the Marra Mamba Iron Formation
ASBBIF	Asbestos deposits in banded iron-formations	FEPIS	Pisolitic iron ore deposits
ASBDLM	Asbestos deposits in dolomite intruded by dolerite	FESCRE	Scree and detrital iron ore deposits
ASBSER	Asbestos deposits in serpentinites	FESED	Sedimentary basin iron ore deposits
ASBUM	Asbestos veins in ultramafic rocks	FGRAN	Fluorite deposits associated with granitic rocks
ASMSS	Stratiform massive arsenopyrite in metasediments	FPEGM	Pegmatite-hosted fluorite deposits
ASQTZV	Arsenic associated with auriferous quartz veins	FVEIN	Vein fluorite deposits
AUALL	Alluvial/eluvial gold deposits	GEMMET	Gem and/or semi-precious stones in high-grade metamorphic rocks
AUBIF	Gold in banded iron-formation and related sediments	GEMPEG	Pegmatite-hosted gem and/or semi-precious stones
AUCONG	Gold in conglomerate within greenstones	GEMSED	Sediment-hosted gem and/or semi-precious stones
AUEPI	Epigenetic gold deposits in precambrian terrains	GEMUM	Ultramafic-hosted gem and/or semi-precious stones
AUFVOL	Felsic volcanic rocks and/or volcanogenic sediments containing auriferous quartz veins and/or shear zones	GEMVOL	Gem and/or semi-precious stones in volcanic rocks
AUGRAN	Gold deposits along granite–greenstone contacts and in granitoid rocks	GRMETA	Graphite deposits in metamorphic rocks
AULAT	Lateritic gold deposits	GRPEG	Pegmatite-hosted graphite deposits
AUPLAC	Precambrian placer gold deposits	GRQTZV	Graphite deposits quartz veins
AUPOR	Gold associated with felsic porphyry within greenstones	GRUM	Graphite as segregations in ultramafic rocks
AUSHER	Basalt and/or dolerite containing auriferous quartz veins along faults or shear zones	GYBBAS	Gypsum in coastal barred-basin deposits
AUSTOK	Dolerite or gabbro containing auriferous quartz stockworks or veins	GYDUNE	Dunal gypsum deposits
AUSYN	Syngenetic gold deposits in precambrian terrains	GYLAKE	Gypsum in lake sediments
AUUM	Gold deposits in ultramafic rocks	HMSCAP	Heavy mineral deposits in the Capel shoreline
BABED	Stratabound bedded barite deposits	HMSDON	Heavy mineral deposits in the Donnelly shoreline
BACAV	Vein and cavity fill deposits	HMSDUN	Heavy mineral deposits in the Quindalup shoreline
BAPEGM	Pegmatite-hosted barite deposits	HMSEN	Heavy mineral deposits in the Eneabba shoreline
BAUKAR	Karstic bauxite deposits	HMSGIN	Heavy mineral deposits in the Gingin shoreline
BAULAT	Lateritic bauxite deposits	HMSHV	Heavy mineral deposits in the Happy Valley shoreline
BIPEGM	Bismuth in quartz-rich pegmatites	HMSMES	Heavy mineral deposits in Mesozoic formations
BIQTZV	Bismuth associated with gold mineralization	HMSMIL	Heavy mineral deposits in the Milyeaanup shoreline
BMMASS	Volcanogenic Cu–Zn deposits	HMSMIS	Heavy mineral deposits — miscellaneous
BMMISS	Mississippi Valley-type Pb–Zn deposits	HMSMUN	Heavy mineral deposits in the Munbinea shoreline
BMPOR	Porphyry Cu–Mo deposits	HMSWAR	Heavy mineral deposits in the Warren shoreline
BMSSED	Sedimentary Cu–Pb–Zn deposits	HMSWRN	Heavy mineral deposits in the Waroona shoreline
BMSHER	Base metal deposits in quartz veins and/or shear zones	HMSYOG	Heavy mineral deposits in the Yoganup shoreline
CADUNE	Limesand in coastal dune sands	KBRINE	Potash deposits in brines and surface evaporites
CALAKE	Calcareous material in lake sediments	KEVAP	Potash deposits in buried evaporite sequences
CALIME	Limestone deposits	KGLAUC	Potash in glauconitic sediments
CASEA	Offshore limesand deposits	KLAKE	Potash associated with lake sediments
CLBED	Bedded sedimentary clay deposits	MGUM	Mafic/ultramafic rocks
CLRES	Residual clay deposits	MNCAV	Joint/cavity-fill manganese deposits
CLTRAN	Transported clay deposits	MNRES	Residual manganese deposits
COJSBT	Jurassic sub-bituminous coal	MNSED	Sedimentary manganese deposits
COLIGN	Eocene lignite deposits	MNSUPR	Precambrian supergene enrichment of manganiferous sediments
COPBIT	Permian bituminous coal	MOPOR	Porphyry Cu–Mo deposits
COPSBT	Permian sub-bituminous coal	NABRIN	Salt in brines and surface evaporites
CRLAT	Lateritic chromium deposits	NAVAP	Salt deposits in buried evaporite sequences
CRPGLY	PGEs and/or chromium in layered mafic/ultramafic intrusions	NIINTR	Nickel in dunite phase of thick komatiite flows
CRPGUM	PGEs and/or chromium in metamorphosed mafic–ultramafic rocks	NILAT	Lateritic nickel deposits
DIAALL	Alluvial/eluvial diamond deposits	NISED	Nickel deposits in metasedimentary rocks
DIALAM	Lamproitic diamond deposits	NITHOL	Nickel deposits in the gabbroic phase of layered tholeiites
DLMBED	Dolomite deposits in sedimentary sequences	NIVEIN	Vein-type nickel deposits
DLMLAK	Residual kankar (dolomite) deposits	NIVOLC	Nickel associated with volcanic peridotites
DLMLAK	Dolomite deposits associated with lake sediments	PCARB	Carbonatite-hosted phosphate deposits
DLMSOM	Metasomatic dolomite deposits	PEGPEG	Pegmatite-hosted industrial minerals
DTMLAK	Diatomaceous lake deposits	PGALL	Alluvial/eluvial platinoid deposits
FEBIF	Primary banded iron-formation deposits	PGUANO	Quaternary guano (phosphate) deposits
		PIGHEM	Specular hematite pigment
		PNOD	Seafloor (nodular) phosphate deposits
		PSSED	Phosphate deposits in Phanerozoic sediments
		PVEIN	Vein phosphate deposits

Appendix 3 (continued)

<i>Abbreviation</i>	<i>Mineralization type</i>	<i>Abbreviation</i>	<i>Mineralization type</i>
REALL	Alluvial/eluvial rare earth deposits	UCAV	Secondary (cavity-fill) vein-like uranium deposits
RECARB	Carbonatite-hosted rare earth deposits	UCONG	Conglomerate-hosted deposits
REFELS	Felsic volcanic-hosted rare earth deposits	ULIGN	Lignite-hosted uranium deposits
REHMS	Rare earth elements in heavy mineral sands	UPEG	Pegmatite-hosted uranium deposits
REPPEG	Pegmatite-hosted rare earth deposits	USST	Sandstone-hosted uranium deposits
RESST	Xenotime in sandstones	UUNCF	Unconformity-related uranium deposits
SBQTZV	Antimony associated with auriferous quartz veins	UVEIN	Uranium in veins associated with base metals
SIDUNE	Mesozoic dune and bedded silica sands	VCALC	Calcrete-related vanadium deposits
SIQTZ	Silica in vein quartz	VERUM	Vermiculite deposits associated with weathered mafic and ultramafic bodies
SIQZTE	Silica in quartzite and/or chert	VTIALL	Alluvial/eluvial vanadium–titanium deposits
SMASS	Sulfur in massive sulfides	VTILAT	Lateritic vanadium–titanium deposits
SNALL	Alluvial/eluvial tin–tantalum deposits	VTIMAG	Titaniferous magnetite deposits
SNGREI	Tin–tantalum deposits in greisen zones	VTIVN	Vanadium–titanium vein deposits associated with base metals
SNPEGM	Pegmatite tin–tantalum–lithium deposits	WMOGRE	Tungsten–molybdenum deposits in greisen zones
SNVEIN	Vein tin–tantalum deposits	WMOPEG	Pegmatite tungsten–molybdenum deposits
SSEDQZ	Sulfur in sediments and/or quartz veins	WSKARN	Tungsten–molybdenum skarn deposits
TALDLM	Talc deposits associated with dolomite		
TALUM	Talc deposits in ultramafic rocks		
UCALC	Calcrete-related uranium deposits		

NOTES: Some mineralization styles listed above will not appear in the database extract.