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South Australia
EarthResources
Information Sheet

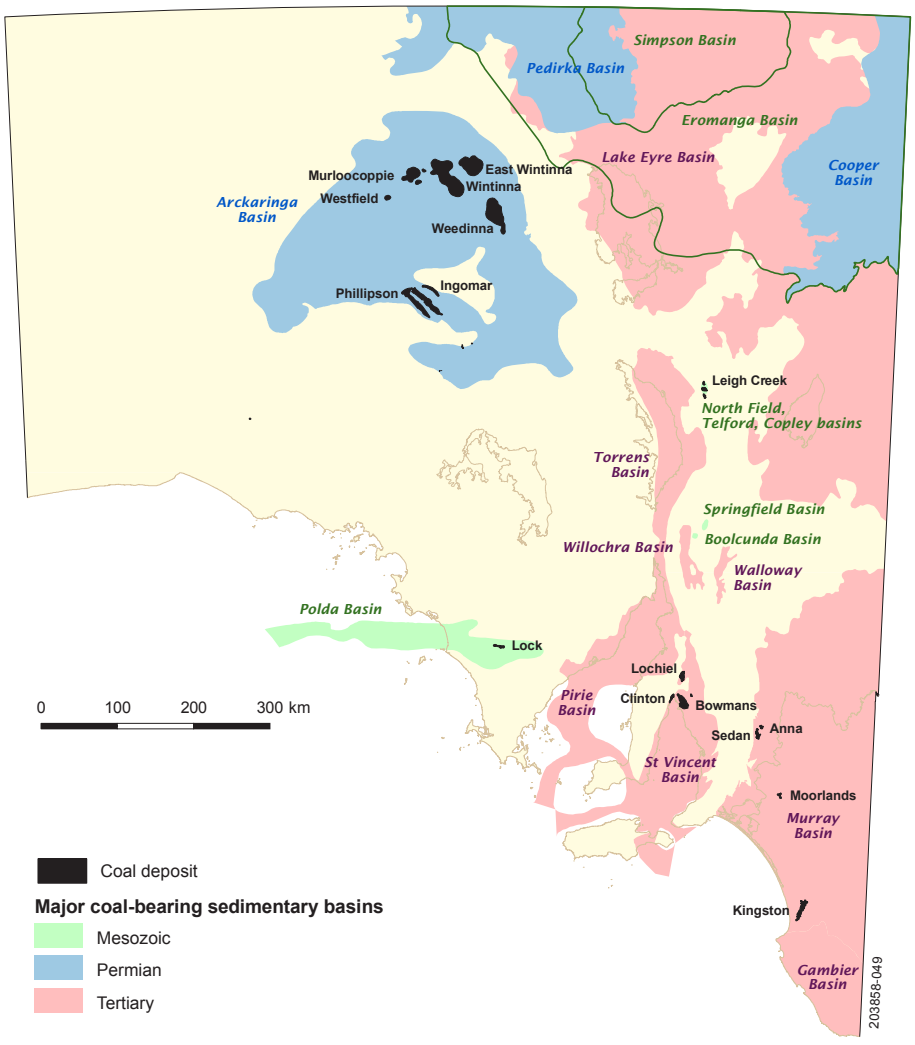
Coal deposits in South Australia

Introduction

Coal measures in South Australia are primarily of Permian, Triassic, Jurassic and Tertiary age. South Australian coals fall into two broad categories: Sub-bituminous C/Lignite A and Lignite B (according to the American Society of Testing Materials, ASTM, rank classification). Collectively, measured and indicated resources for the major deposits in South Australia exceed 6 billion tonnes, with a further 14 billion tonnes of inferred resources.

The depth and maturity of the coal deposits, and distance to infrastructure and markets, have prevented economic development of all except the Leigh Creek Coalfield. Over the last 20 years, coal research in the state has focused on proving up known deposits for mining and power generation, and only limited greenfield coal exploration has taken place. The potential to convert South Australian coal reserves into more greenhouse friendly fossil fuels through coal seam methane (CSM), underground coal gasification (UCG), coal to liquids (CTL) and gas to liquids (GTL) technologies has led to renewed interest in these deposits.

CSM is now an important source of gas in eastern Australia and is being produced primarily from the Bowen and Surat basins in Queensland and New South Wales. CSM exploration is also underway in Tasmania, Victoria and Western Australia.



Coal deposits in South Australia

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Department of State Development

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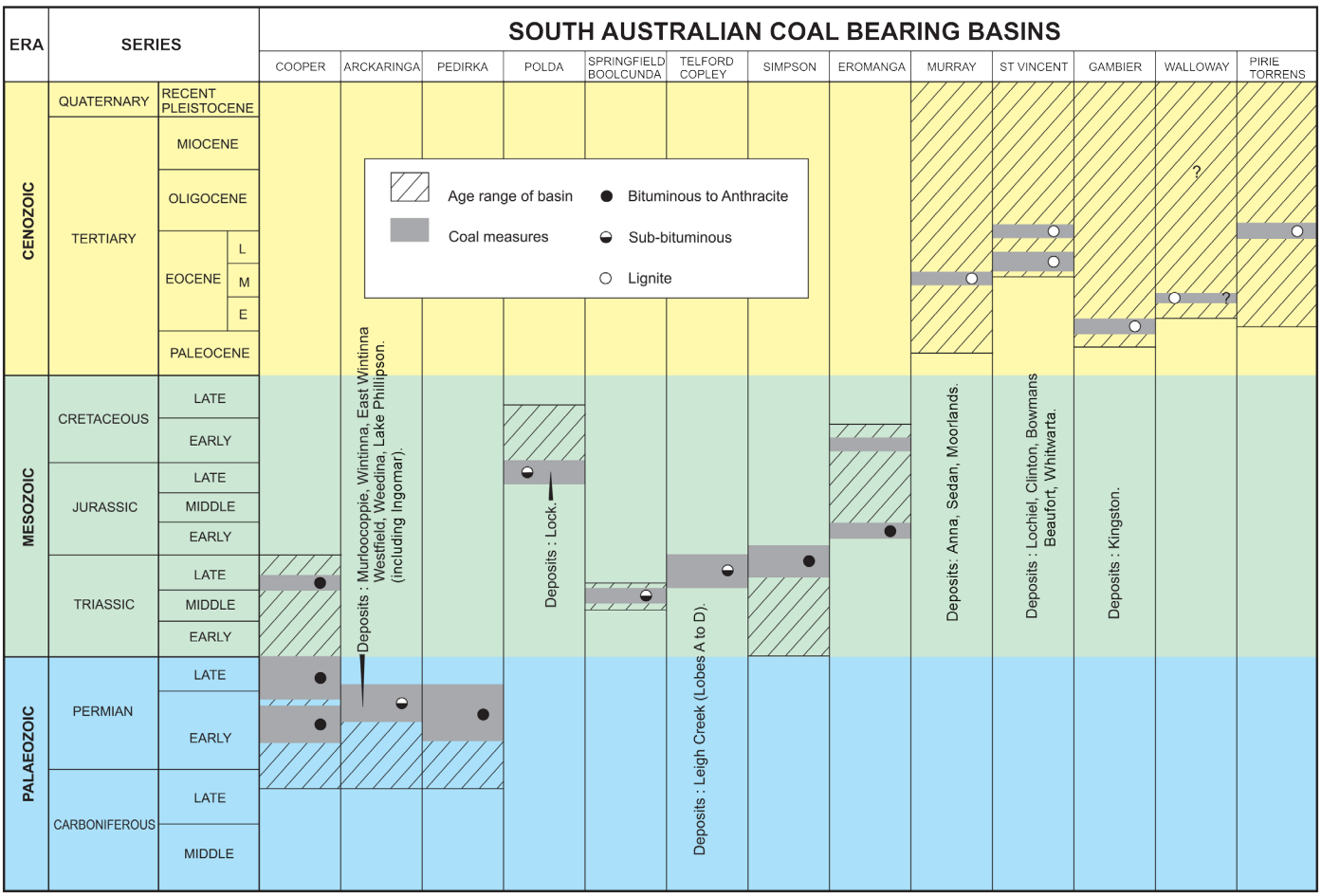


Coal-bearing basins in South Australia

Exploration interest in South Australia has increased over the last five years following increased CSM production from black coal in the eastern states and success achieved in producing biogenic methane from low-ranked coal in the United States.

Legislation

Mining Act 1971

Petroleum and Geothermal Energy Act 2000

Permian coal

Extensive and thick Permian coal measures occur in the intracratonic Arckaringa, Pedirka and Cooper basins.

Arckaringa Basin

The sub-bituminous coals in the Arckaringa Basin have features (thickness, continuity and suitable depth) which make them appealing for coal seam gas potential to produce distillate, naphtha and other fuels, based on the long established CTL technology.

Arckaringa Coalfield

Current resource estimates for the Arckaringa Coalfield are 10 000 Mt of low-grade, sub-bituminous coal. Heat value, moisture and ash contents of the coal are relatively uniform throughout the coalfield:

- Low ash, 6% in situ.
- Low sodium-in-ash, 0.8–2.2%
- Heat value of 18 MJ/kg.
- Sulfur content tends to be variable.

Applications are currently under consideration for exploration rights for CSM and/or gasification over these coal deposits. Four deposits are identified within the Arckaringa Coalfield – Wintinna, East Wintinna, Murloocoppie and Westfield.

Wintinna deposit

- 8–10 persistent seams.
- Cumulative coal thickness 15–25 m.
- Top of mineable coal 104–240 m.
- Measured and indicated resource of 2 billion tonnes.
- Size, depth of overburden and location suggests Wintinna may lend itself to large scale open-cut development with either an onsite or coastal coal-fired power station.
- Coal is suitable for conventional, pulverised fuel power stations.

East Wintinna deposit

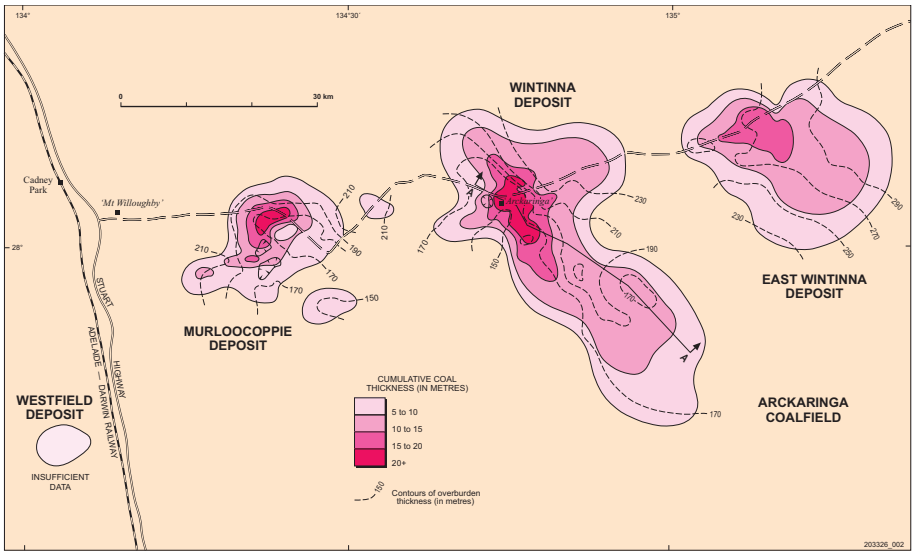
- 6–7 persistent seams.
- Cumulative coal thickness up to 20 m.
- Top of mineable coal 220–300 m.

Murloocoppie deposit

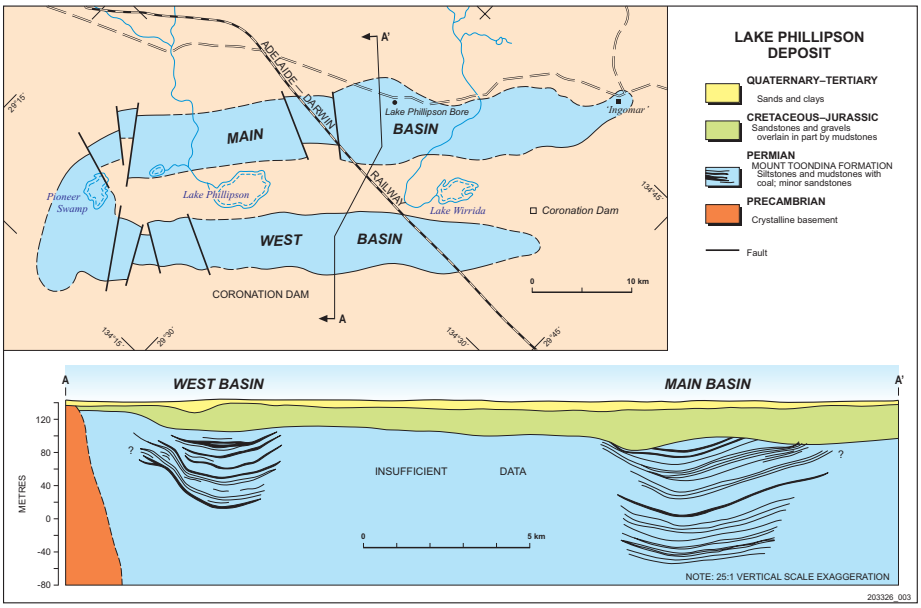
- 8 persistent seams.
- Cumulative thickness averages 20 m.
- Top of mineable coal 140–230 m.

Westfield deposit

- 2 persistent seams.
- Thickness ranges from 1–9 m.
- Top of mineable coal 145–215 m.



Arckaringa Coalfield



Lake Phillipson deposit

Weedina deposit

Deposit occurs within the Boorthanna Trough on the eastern side of the Arckaringa Basin.

- 6 major and several minor coal seams.
- Cumulative thickness of 35 m.
- Top of mineable coal 130–150 m.
- Overburden containing the major aquifers of the Great Artesian Basin.
- Estimated coal resource of 7200 Mt.
- Coal is suitable for conventional, pulverised fuel power stations.

Lake Phillipson deposit

It occurs in two long, shallow northwest-trending sub-basins (Main and West Basin) within the Phillipson Trough, along the southern margin of the Arckaringa Basin.

- 6 major coal seams.
- Cumulative thickness up to 25 m.
- Top of mineable coal 50–143 m.
- Total resource is estimated at 5000 Mt.
- Coal quality is comparable to the other coal deposits in the Arckaringa Basin except for high sodium and chlorine levels (~2%).
- Currently under licence for oil, conventional gas and CSM.

Cooper Basin

- Bituminous to anthracite – the highest rank found in South Australia.
- Numerous thick coal seams.
- At depths ranging from 1300–4000 m.
- Seams are up to 25 m thick.
- Resources in the order of hundred of billions of tonnes.
- Dwarfs all other known deposits in Australia.
- Currently under application for CSM; in situ gasification is also being considered.

Pedirka Basin

Most coal in the eastern Pedirka Basin is too deep (>2500 m in Oolarinna 1 in the Poolowanna Trough).

- Sub-bituminous coals of Purni Formation well developed at suitable depths (600–1500 m) in western part of basin.
- Slightly elevated mud gas recorded in Purni Formation coals.
- In Mt Hammersley 1, 30.5 m of coal occurs between 600–760 m.
- Currently fully under licence for conventional oil and gas and CSM.

Triassic coal

Telford, Copley and North Field basins

Leigh Creek Coalfield

The coalfield occurs as four small discrete basins – Lobe A (Copley Basin), Lobe B (Telford Basin), Lobe C and Lode D (North Field).

- Only operating coal mine in South Australia.
- Open-cut method of mining.
- Owned and operated by NRG Flinders Inc.
- ~3 Mt low-grade sub-bituminous coal produced per year.
- Used in the 240 MW Thomas Playford B Power Station and the 2 x 250 MW Northern Power Station.

Lobe A – Copley Basin

- Numerous seams.
- 1–3 m thick.
- Total coal resource of around ~11 Mt.

Lobe B – Telford Basin

- Total coal resource of 500 Mt but due to steeply dipping seams is limited to

between 60 and 100 Mt at depths of ~200 m.
- Depth of burial in the centre exceeds 1000 m.
- Coal occurs in three principal series – Lower, Main and Upper.
- Upper and Lower series contain numerous seams up to 5 m thick.
- Lower Series seams are generally the poorest and are thin with relatively high ash content.
- The Main Series is essentially a single seam varying in thickness from 6–18 m.
- Most of the coal mined at Leigh Creek comes from the Lobe B Main Series.
- Upper Series also provides significant quantities of coal.

Lobe C – North Field
- 1 seam.
- 1.6–16 m thick.
- 8.4 Mt of the total 20 Mt mined due mainly to increasing depths.

Lobe D – North Field
- 2 coal seams.
- Range in thickness from 6–9 m.
- 22 Mt extracted.

Jurassic coal

Polda Basin

Lock deposit

The coal occurs in the Polda Basin, in a narrow east–west trending sub-basin and consists of numerous flat to gently dipping seams of high ash coal.

- A coal resource of 320 Mt has been delineated.
- Low-grade, sub-bituminous coal.
- Numerous flat to gently dipping (2 to 5°) seams.
- Cumulative coal thickness between 5–17 m.
- High ash content, commonly between 20–35% in situ.
- Aquifer systems lie above and below the coal zone.

Applications are currently under consideration for exploration rights for CSM and/or gasification over this coal deposit.

Tertiary coal

South Australia has large resources of low-rank brown coal (lignite), of Middle to Late Eocene age, distributed widely in Tertiary sedimentary basins in the southern part of the state.

- Lignite is generally high in moisture, sulfur, sodium and chlorine.
- Development of these deposits for power generation would have advantages.
- Conveniently located to centres of demand for electricity.
- Could be mined cheaply by open-cut methods.
- Other possible uses include CSM, gasification, liquefaction and briquetting.

Applications are currently under consideration for exploration rights for CSM and/or gasification over these coal deposits.

St Vincent Basin

Five significant deposits of lignite occur in the northern St Vincent Basin – Bowmans, Lochiel, Beaufort, Whitwarta and Clinton deposits. Lignite occurs at depths between 20–150 m.

Bowmans deposit
- Measured and indicated resource of 1250 Mt.
- Coal occurs at 55–100 m below the surface.
- Cumulative thickness of 25 m.
- High sulfur and chlorine content.

Lochiel deposit
- 625 Mt of lignite.
- Lignite occurs in 3 seams.
- Cumulative thickness of 14 m.
- Depth to lignite between 20–70 m.

Beaufort and Whitwarta deposits
- Consist of a number of flat-lying, thin lignite seams 1–5 m thick.
- Depth to lignite 40–60 m below ground level.

Clinton deposit
- 4 main seams.
- Average thicknesses of 3 m.
- Depth to lignite 50–100 m.

Gambier Basin

Kingston deposit

Considered to be better than many of the other lignites in the state.

- 985 Mt of lignite in a single seam.
- 2 main lobes with the maximum lignite thickness of 12 m.
- Depth of lignite between 40–75 m.
- Significant environmental and hydro-geological investigations have been carried out to establish the likely regional impact of mine dewatering.

Leigh Creek coal mine. (photo 408324, 408325)

Coal resources of South Australia – in situ tonnage and quality (South Australia Department of Mines and Energy 1987).

Deposit		Rank (ASTM)	Coal tonnage		Proximate analysis					Impurities		
			Measured-Indicated (Mt)	Inferred (Mt)	Moisure (%)	Ash (%)	Volatile matter (%)	Fixed	Heat value (MJ/kg)	Total sulfur	Chlorine (%)	Sodium-in-ash
Arckaringa Coalfield	Wintinna	Sub-bituminous	1850	2270	35	6	25	34	18.5	1.2	0.04	2
	East Wintinna		975	1200	38	6	22	34	17.2	0.7	0.02	1
	Murloocoppie		—	1450	35	7	25	33	17.6	3.1	—	2
	Westfield		140	490	35	7	25	33	17.8	3.1	—	1
Lake Phillipson			—	4700	30	13	25	32	17.0	1	1.70	10
Leigh Creek Coalfield	Copley Basin Lobe A		11	—	37	12	20	31	15.2	2.9	—	—
	North Field Lobe C		12	—	29	22	22	27	13.3	3.0	—	—
	Telford Basin Lobe B		150	350	33	16	21	30	15.8	0.4	0.27	4
Lock			260	–	26	23	30	21	14.6	0.4	—	2
Northern St Vincent Basin	Bowmans	Lignite	1250	350	56	5	22	17	10.6	2.2	0.50	14
	Clinton*		340	440	53	9	18	20	9.4	1.9	—	16
	Beaufort*		255	45	—	—	—	—	—	—	—	—
	Whitwarta*		145	185	55	12	19	14	9.4	2.6	—	9
	Lochiel		585	—	61	6	19	14	9.1	1.1	0.18	6
Kingston†			985	—	53	7	22	18	10.6	1.5	0.11	6
Anna			58	—	54	11	21	14	9.9	1.8	—	2
Sedan			231	—	58	9	19	14	9.4	2.3	0.08	3
Moorlands			32	—	55	9	18	18	9.9	1.8	0.14	3

* Combined total 558 Mt (Indicated and Inferred) – Syngas 2008. <*www.syngas.com.au*>.

†Combined total 578.3 Mt (Measured and Indicated) – Hybridenergy 2007. <*www.hybridenergyaustralia.com.au*>.

Murray Basin

Sedan deposit

- Contains 184 Mt of lignite.
- 2 main lignite seams between 5–8 m thick.
- Average depth of lignite 50 m.

Anna deposit

- Coal occurs over an area of 3 x 4.5 km.
- Thickness up to 8 m.
- Coal at depths between 60–85 m.

Moorlands deposit

- Lignite occurs in 6 small sub-basins.
- Lignite of poor quality.
- A combined resource of 32 Mt.
- Average thickness between 5–9 m.
- Depth of lignite between 14–92 m.

Further information

For further information on the coal prospects in South Australia, please refer to the Department of State Development minerals and petroleum websites and the following references:

Drexel JF and Preiss WV eds 1995. *The geology of South Australia, Vol. 2, The Phanerozoic,* Bulletin 54. Geological Survey of South Australia, Adelaide.

Sansome A, Nitschke L and Tingate PR 2007. Coal seam methane potential of South Australia. *MESA Journal 47:11–13.*

South Australia Department of Mines and Energy 1987. *Coal deposits in South Australia,* Mineral Information Series. South Australia Department of Mines and Energy, Adelaide.

SARIG (South Australian Resources Information Geoserver) provides up-to-date views of mineral, petroleum and geothermal tenements and other geoscientific data. You can search, view and download information relating to minerals and mining in South Australia including:

- Tenement details
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www.statedevelopment.sa.gov.au/sarig