Potential and Outlook

Moderate potential exists for celestite (also known as celestine) deposits in the Murray Basin of western New South Wales (Figure 5). This assessment is based on:

- the presence of several celestite occurrences in western New South Wales
- widespread occurrence of celestite in the far north of South Australia, central Queensland, and northern Victoria (Olliver & Barnes 1990)
- association of celestite with evaporite minerals, such as salt, gypsum and carbonates, which are known to occur widely in the Murray Basin.

Fourteen occurrences of celestite are known from New South Wales, mainly from the Murray Basin but also from the Great Australian Basin (Ray et al. 2003). Within the Murray Basin, the main cluster of occurrences is near Wentworth in the southwestern part of the state.

Ray (1996) noted that the occurrence of celestite in a number of locations in the upper, evaporitic part of the Blanchetown Clay indicates that there is some potential for economic deposits.

Suggested exploration strategies could involve field investigations in areas of known celestite deposits or where gypsum and/or limestone occur. Such studies could be complemented by analysis of water from water bores in the vicinity of known occurrences.

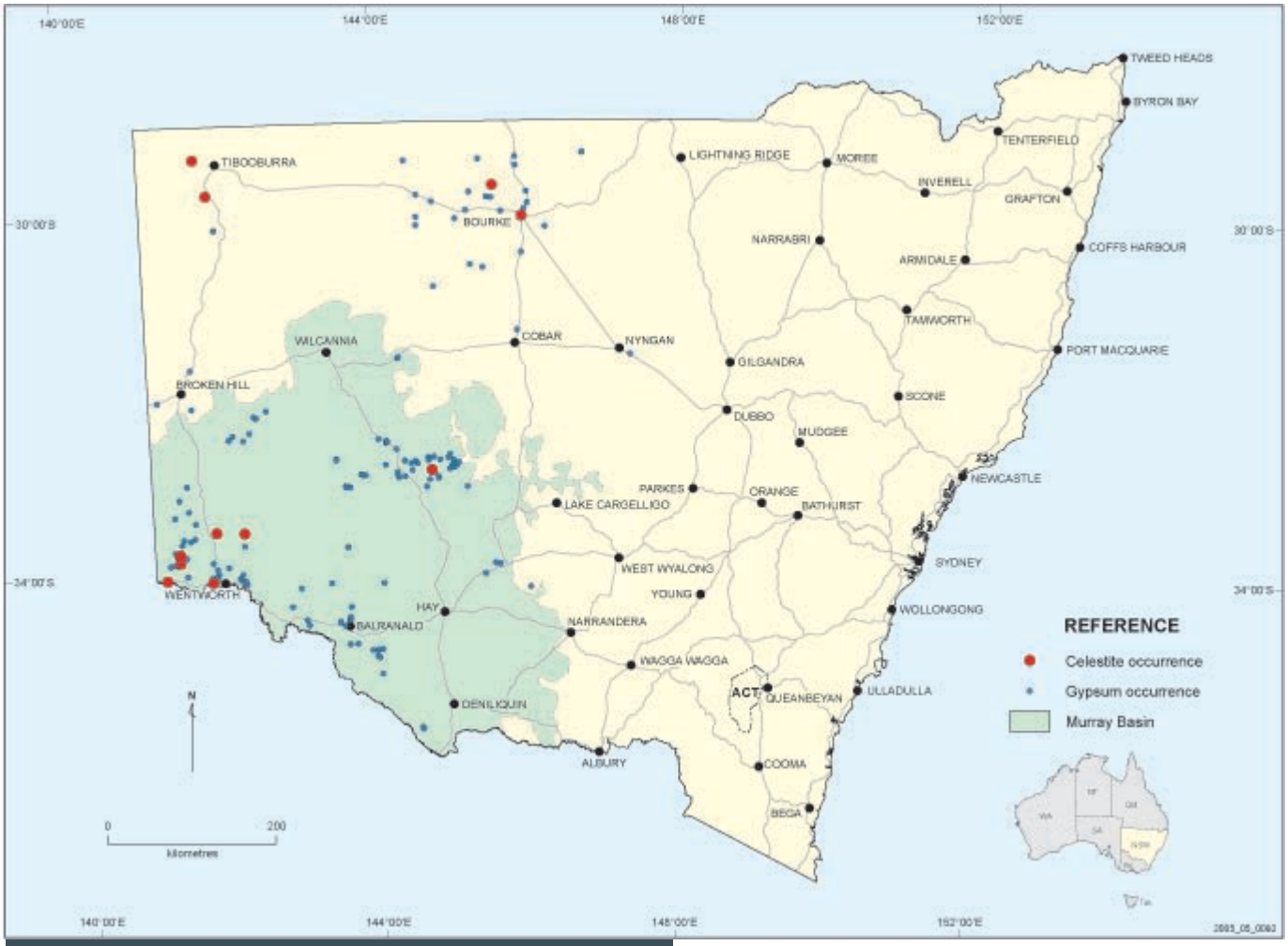

Figure 5. Celestite occurrences in New South Wales

Nature and Occurrence

Celestite ($SrSO_4$) is the only commercial source of strontium. Celestite is converted by processing to strontianite ($SrCO_3$) the main product used by industry. The properties of celestite and strontianite are listed in Table 4.

Table 4. Main properties of celestite and strontianite

Mineral	Celestite	Strontianite
Formula	$SrSO_4$	$SrCO_3$
Colour	white, pale blue	colourless, white, grey, yellow-brown, greenish, reddish
Specific gravity	4	3.8
Hardness	3–3.5	3.5
Habit	tabular, elongated and lathlike	prismatic, acicular

Source: Harben (1999)

In 2004, known world production of strontium minerals was about 510 000 t (Ober 2005). Main producers are Spain, Mexico, China and Turkey. Mexico and Spain account for about 70% of recorded production. World resources are estimated at about one billion tonnes.

Deposit Types

According to Harben and Bates (1990), and Harben and Kužvart (1996) and Warren (1999), deposits of strontium minerals can be classified into four types (Table 5).

Sedimentary

Sedimentary deposits are the main commercial source of strontium minerals. Strontium minerals develop in lakes and lagoons with gypsum, carbonates and other rocks in the form of concretions, seams or impregnations. Celestite forms either as a primary precipitate or, more commonly, by the interaction of gypsum or anhydrite with strontium-rich waters (Warren 1999).

Volcano-sedimentary

These deposits form in lakes associated with volcanic rocks, such as rhyolite, andesite and basalt. Deposits are up to 5 m thick and may contain 20–55% strontium minerals.

Infiltration or Lateral Secretion

Strontium minerals occur as geodes in limestone, as celestite veins (with strontianite) in clays and carbonate rocks, and as metasomatic bodies in carbonates and sulphate rocks. Strontium is leached from the neighbouring rocks.

Hydrothermal

In hydrothermal deposits, celestite is commonly accompanied by fluorite, barite, calcite, lead and zinc sulphides, and strontianite ($SrCO_3$). Strontium can be a by-product of mining of the associated minerals.

Table 5. Important celestite deposit types

Deposit Type	Examples
Sedimentary	Coahuila State, **Mexico**; Nakhjir in the Dasht-e-Kebir Desert, **Iran**; Avon County, **England**; Argus Station, Avawatz Mountains, Barstow, all in San Bernadino County, California, **USA**
Volcano-sedimentary	Ludlow, Vermont; Aguila, Gila Bend, Arizona all in **USA**
Infiltration or Lateral Secretion	**Turkmenistan**; **Tadzhikistan**; Sicily, **Italy**; Munster, **Germany**
Hydrothermal	Sierra Mojada, **Mexico**; Salem, Kentucky, Fidalgo Island, Washington (State), **USA**

Source: Harben (1999)

Main Australian Deposits

The only commercial Australian production of celestite was in South Australia at Wooldridge Creek, 40 km northwest of Oodnadatta, where some 113 t was mined (Olliver & Barnes 1990).

New South Wales Occurrences

Known New South Wales occurrences of celestite are all in the western part of the state. Eleven occurrences of celestite are recorded (Ray et al. 2003), mainly from the Murray Basin but also from the Great Australian Basin.

In the Wentworth area, celestite occurs as nodules up to 10 cm in diameter, commonly associated with gypsum and dolomitic limestone (Ray 1996). At Canoble, near Ivanhoe, small irregular nodules of celestite are sporadically distributed throughout a clay bed in which gypsum occurs (Jones 1925). In the northwest of the state, near Olive Downs, celestite occurs as veins in limestone (Byrnes 1977).

Byrnes (1977) considered that the celestite occurrences associated with Great Australian Basin deposition in New South Wales may have formed from strontium derived from Cretaceous rocks.

Applications

Almost all celestite (99%) is used in the production of strontium carbonate (Anon 1999). There are four main uses for strontium carbonate.

1. Glass: $SrCO_3$ (strontianite) is used in faceplate glass in TV and CRT glass to block X-rays and to improve glass quality.
2. Ceramic ferrite magnets: $SrCO_3$ is mixed with iron oxide and processed to form strontium hexaferrite for use in permanent ceramic magnets.
3. Pyrotechnics: Strontium compounds burn to produce a brilliant red flame and so are used in pyrotechnic materials, such as flares and fireworks.
4. Metallurgy: Strontianite is used to remove lead during electrolytic production of zinc.

Substitution of strontium by barium is possible in some applications. However, there could be an adverse impact on performance of such materials as colour television picture tube glass and production costs may increase (Ober 2005).

Economic Factors

The strontium market is dependent on television and computer monitor sales. Long-term outlook will depend on continuing demand for televisions and monitors using colour cathode ray tube technology (Harben 1999).

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