



NSW DEPARTMENT OF  
**PRIMARY INDUSTRIES**

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## Potential and Outlook

In New South Wales, beryl occurs as irregular, scattered concentrations in pegmatite in the New England and Broken Hill regions. There is potential for more small deposits north of Emmaville associated with the highly fractionated I-type Mole Granite. Similarly, pegmatites in the Broken Hill region offer further opportunities for the discovery of beryl and aquamarine.

## Nature and Occurrence

Beryllium occurs in many minerals. The principal beryllium-bearing minerals of economic interest are beryl  $\text{Al}_2[\text{Be}_3\text{Si}_6\text{O}_{18}]$  and bertrandite  $\text{Be}_4\text{Si}_2\text{O}_7(\text{OH})_2$ . Beryl is the principal ore of beryllium, although bertrandite has considerable importance in the USA, where large, low-grade epithermal deposits are mined.

The patchy occurrence of beryl usually restricts production to small-scale operations. These are commonly associated with feldspar mining where the beryl is recovered by handsorting of crushed pegmatite. In contrast, bertrandite can be extracted by surface mining methods and processing involving acid treatment and purification. The gem members of the beryl family aremorganite (pink), heliodor (golden), aquamarine (pale blue to blue-green) and emerald (brilliant green).

World mine production of beryllium in 2004 has been estimated at 166 tonnes (Cunningham 2005). Total world reserves are unknown, but may exceed 80 000 tonnes. The major world producers of beryl are the USA, China, Russia, Kazakhstan and Mozambique. USA is the sole supplier of bertrandite (Harben 1999).

## Deposit Types

The world's major sources of beryl are granitic pegmatites, quartz veins and replacement deposits (Kramer 1994).

### *Granitic pegmatite*

Granitic pegmatites are the principal source of beryl. The beryl usually occurs in zoned pegmatites with plagioclase, quartz and muscovite, but may also occur with spodumene, amblygonite and feldspar.

The grainsize of the beryl usually increases towards the inner zones of the pegmatite. Granitic pegmatite deposits occur in Brazil, Black Hills (USA), and the Broken Hill region (New South Wales).

### *Quartz veins and beryl-bearing granite*

Beryl may occur in quartz veins or disseminated in granite in conjunction with cassiterite, wolframite, molybdenite and other minerals. These quartz veins are genetically similar to granite pegmatite deposits. Examples of this type of deposit are found in Colorado, Arizona and Utah in the USA.

### *Replacement deposits*

Replacement deposits include carbonate-bearing rocks that have been replaced by various minerals, including bertrandite, and emerald-bearing schists. Replacement deposits occur at Spor Mountain and Iron Mountain, USA.

## New South Wales Occurrences

There are 107 recorded occurrences of beryl in the state, mainly in the New England and Broken Hill regions (Ray et al. 2003). During the years 1891 and 1892, a total of 50 000 carats of beryl obtained from near Emmaville were sent to London (Rayner 1960). However, only a very small percentage was of good quality and, by 1897, the mines closed. Some prospecting occurred from 1908 to 1963 but was unsuccessful. Historically, New South Wales has produced about 110 t of beryl up to the end of 1957.

Much of New South Wales industrial beryl production has been from pegmatites in the Broken Hill area. The main mines were at Egebek, where the Triple Chance, Lady Beryl and Spar Ridge mines were the largest producers. Other beryl localities occur around Broken Hill and in the Euriovie area where an unusual caesium-bearing beryl has been reported (Rayner 1960).

Most of the gem-quality beryl, emerald and aquamarine, has been produced from the Emmaville-Torrington area, near the contact of the Mole Granite and sedimentary rocks, commonly in association with silexite (quartz-topaz rock) (Henley et al. 2001). Gem-quality beryl has also been reported from the Inverell

area, Dundee, Glen Innes, and in alluvial tin deposits at Stanborough, Tingha and Copes Creek. Other reported localities outside the New England region are at Black Range near Albury, Ophir, Cooma, Bungonia and Kiandra (Rayner 1960; MacNevin & Holmes 1980).

## Applications

Beryllium is a high-strength, lightweight metal with a high resistance to corrosion that can be used in its metallic or oxide form. Beryllium has a wide variety of applications, including the manufacture of electrical equipment, nuclear reactors, electronic components and aerospace components.

Beryl and bertrandite ores are processed to beryllium hydroxide for use as feedstock for the production of beryllium metal, alloy and oxide. The use of beryllium (as an alloy, metal and oxide) in electronic and electrical components and aerospace and military applications currently accounts for an estimated 80% of total consumption. Gem-quality beryl is used in the jewellery trade.

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