



NSW DEPARTMENT OF
PRIMARY INDUSTRIES

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Photograph 19. Cut blue and gold New England region sapphires. New South Wales has been one of the world's principal suppliers of sapphires. Sapphires have traditionally been recovered from the Inverell and Glen Innes regions. (Photographer D. Barnes)

Potential and Outlook

Australia has been the source of up to 70% of the world's sapphires (Photograph 19), with New South Wales accounting for more than half of production. The Kings Plains deposits, northeast of Inverell, are arguably the richest single accumulation of gem-quality sapphire ever mined (Figure 23). There is moderate to good potential for more commercial deposits of sapphire in the existing mining areas in the New England district and unknown, but probably limited potential, in other areas of Tertiary alkali basalt volcanism (Figure 23).

In recent years the sapphire market has softened, partially because of a downturn in world economic growth, resulting in many of the sapphire operations in the New England area being placed on care and maintenance (Department of Mineral Resources 2003). However, significant resources of ruby- and sapphire-bearing alluvial gravels have been identified in the Barrington Tops area. Cluff

Resources Pacific NL (2002) has estimated an inferred resource of at least fourteen million carats of ruby and a similar resource of sapphire in the Gummi River valley, west of Gloucester. Mining of the resource began in early 2005 (Cluff Resources Pacific NL 2005). There is good potential for more deposits of ruby and sapphire in the Barrington Tops area (Sutherland & Graham 2003).

Exceptional grades have been recorded in alluvial reworked volcanoclastic sequences in the New England region, particularly in the Kings Plains region and near Braemar, with these rocks being prime exploration targets for major sapphire deposits (Oakes et al. 1996). Volcanoclastic rocks, products of early explosive stages of Tertiary basaltic volcanic episodes, are widespread in the New England region and elsewhere in eastern Australia. These volcanoclastic rocks are a major source of alluvial corundum, sapphire and ruby in eastern New South Wales.

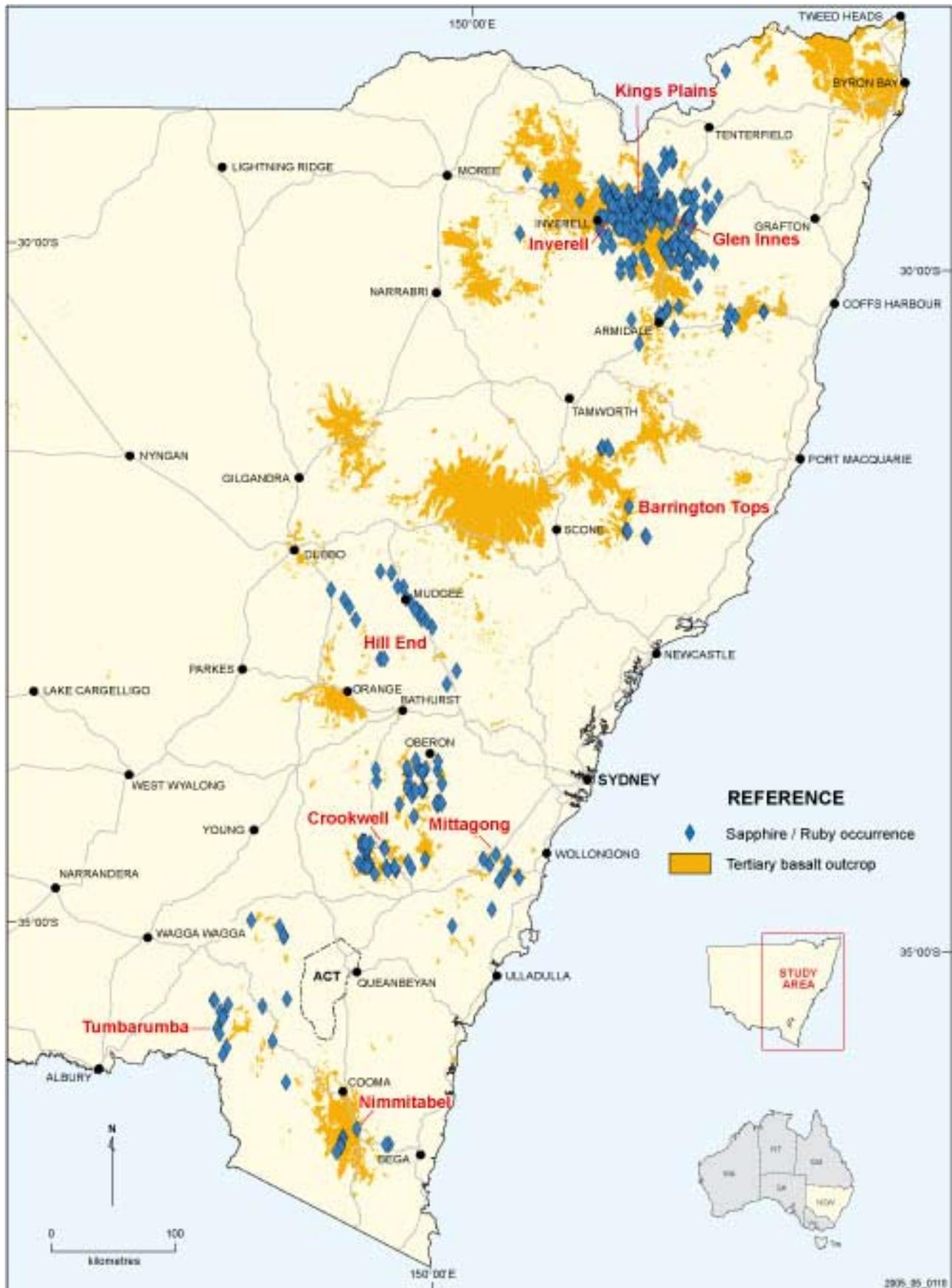


Figure 23. Sapphire and ruby occurrences and associated prospective Tertiary volcanic rocks

Nature and Occurrence

Sapphire and ruby are gem varieties of the mineral corundum (Table 34). The term sapphire is applied to corundum of any colour except red corundum, which is termed ruby.

Table 34. Main properties of corundum

Mineral	Corundum
Formula	Al ₂ O ₃
Colour	Ruby — red Sapphire — commonly colourless, light to dark blue and parti-coloured (blue and green or blue and yellow) rarely green, yellow, orange, pink and purple
Specific Gravity	3.95–4.10
Hardness	9

Source: MacNevin and Holmes (1980)

Estimates of world resources are not available, and there is a general lack of information on the extent and grade of most known sapphire deposits. Nevertheless, resources are believed to be substantial, despite prevalent industry opinions that reserves in many of the world's traditional sapphire-mining regions are becoming depleted.

Historically, the world's most important sapphire sources have been Burma, Sri Lanka, Thailand, Laos, India and Australia. Commercial deposits also occur in Nigeria, the USA, Slovakia, Borneo, Madagascar, Russia, Romania and some South American nations (Oakes 1993).

Deposit Types

The principal modes of occurrence of sapphire are summarised below (Oakes 1993; Oakes et al. 1996; Simandl & Paradis 1999).

- As megacrysts in aluminous metamorphic rocks (primarily Sri Lankan deposits; Montana, USA; Thackaringa near Broken Hill, New South Wales).
- Pegmatite veins (Kashmir deposits; Flinders Range, South Australia; Byrock north of Cobar, New South Wales; Mount Leura, Queensland).
- Basic to ultrabasic dykes and veins (Montana, USA).
- Contact metamorphic/metasomatic occurrences, in which corundum is found within or near aplite and pegmatite dykes, sills or plugs cutting mafic and ultramafic rocks or found (commonly) along mafic/ultramafic intrusive contacts with metapelites or other felsic country rocks (New York, USA; South Africa, Kenya, Tanzania).

- Tertiary alkali basalt sequences, particularly volcanoclastic units (western Pacific continental margin gemfields (Sutherland et al. 2004); Africa; Madagascar).
- Placer deposits derived from the above occurrences.

The western Pacific continental margin, over 12 000 km long, hosts the most productive corundum gemfields, including those in eastern Australia, as well as South East Asia (Laos, Vietnam, Thailand, Cambodia), East China (Fujian, Shandong and Hainan provinces) and up into eastern Russia (Primor'è). Sutherland et al. (2004) suggested that there may be an underlying geological control on the western Pacific gemfields.

Main Australian Deposits

Although many occurrences of sapphire have been recorded in all eastern Australian states, including Tasmania, the only deposits that currently support commercial mining are the Anakie and Lava Plains gemfields of Queensland, and the New England area of New South Wales.

In 2000 the value of sapphire production from the Queensland deposit was estimated to be less than A\$1 million a year (Brown 2000).

New South Wales Occurrences

New South Wales has long been a significant supplier of sapphire to world markets. The contribution to world output remains speculative owing to the lack of an authoritative source of comparative production statistics (Oakes 1993). There are 378 occurrences of sapphire and 41 occurrences of ruby recorded in New South Wales (Ray et al. 2003).

Most sapphire occurrences in New South Wales are found in the New England region. They occur in deep leads and in alluvial gravels of present-day radial drainage systems that drain areas of alkali basalts in the Inverell–Glen Innes area (Figure 23). Local geomorphology of current and palaeo-river valley systems plays an important role in concentrating the sapphires. An understanding of these systems is necessary in order to locate the deposits.

The volcanoclastic deposits associated with alkali basaltic volcanism, and to a lesser extent the alkali basalts themselves, are recognised as the source rocks of the sapphire (Lishmund & Oakes 1983). Alluvial reworking of these volcanoclastic deposits has concentrated the sapphire into grades greater than 200 grams per bank cubic metre, with some grades as high as several kilograms per bank cubic metre at Kings Plains and Braemar (Pecover 1994).

In the recent past, considerable exploration activity has been undertaken in the New England region to identify new resources, including the location of primary sources. This work has been largely initiated in response to the innovative ideas on sapphire genesis developed by the Geological Survey of New South Wales. Ongoing collection of geochemical, isotopic and geophysical data and age dating are being undertaken in the Inverell–Glen Innes area (Figure 23), enabling the differentiation and mapping of the New England Tertiary basalts (N Vickery and K.R.Malloch pers. comm., 2004). Such studies had previously only been accomplished at localised scales (e.g. Duggan 1972; Oakes et al. 1996).

The New England basalts can be divided into two geochemical groups: those of alkali basalt composition associated with sapphires; and the sapphire-barren basalts of tholeiitic composition. The alkali basalts occur in the eastern portion of the outcropping basalts, corresponding to the distribution of the majority of the alluvial sapphires (McEvelly et al. 2003). The delineation of the alkali basalts and associated volcanoclastic units will aid in guiding further sapphire exploration in the New England region.

Sapphires of good quality have been recovered from Holocene alluvial deposits in many parts of the state (Figure 23), including Nundle (southeast of Tamworth), the Oberon–Porters Retreat area (near Oberon), Mount Werong (west of Picton), the Crookwell area, Berrima–Mittagong area, Hill End, the Cudgong–Macquarie River system (near Mudgee), the Tumbarumba area, Wee Jasper and Kiandra (in the Southern Highlands), the Nimmitabel area, and the Shoalhaven River (Holmes et al. 1982).

Production value of sapphire in New South Wales averaged A\$8.44 million per year for the period 1990 to 1999. Annual production values for 1997 to 2003 are recorded in Table 35 (data on sapphire quantity are not collected).

Table 35. Sapphire production in NSW 1997–2003

Year	Value (A\$M)
2002–2003	1.90
2001–2002	3.04
2000–2001	5.60
1999–2000	3.17
1998–1999	4.70
1997–1998	4.96

Source: New South Wales Department of Mineral Resources (2003)

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