Potential and Outlook

Although there has never been any production in New South Wales or anywhere else in Australia, there is excellent potential for wollastonite in the state. In the case of New South Wales this may be due to a lack of recognition of the potential for wollastonite deposits.

A large number of skarn-associated occurrences of wollastonite have been recorded within the Lachlan Orogen and the New England Orogen, and several of these appear to contain significant amounts of wollastonite (Figure 30). Many other skarns have never been evaluated for their wollastonite content.

The most promising deposits appear to be those at Doradilla, near Bourke in the northwest of the state, where wollastonite is a major component of an unusual skarn deposit that was originally prospected for tin and copper. There is little outcrop, but extensive diamond drilling revealed that the gangue consists largely of wollastonite and fluorite (North Broken Hill Ltd 1974a, b). The potential resources of wollastonite (and fluorite) in that deposit are very large, although the near-surface parts of the deposit may be deeply weathered.

Large deposits of wollastonite occur as gangue to the Browns Creek skarn-associated gold–copper deposit near Blayney, south of Bathurst (Figure 30). This mine has been abandoned, and the open cut has filled with water. Although the tailings from the mine contain significant amounts of wollastonite, their availability for future processing is unknown. The skarn at Browns Creek extends outside the area which has been mined, and there is potential for further deposits.

Minor occurrences of wollastonite are common in the state and some deposits, such as Jeremiah Creek, south of Burrinjuck near Yass (Figure 30), have been considered in the past as potential sources. However, no detailed evaluation has occurred.

Wollastonite-bearing skarn rocks occur across the state, and some of these may have economic potential, but few have been evaluated (Malloch 2004). Skarns within the aureoles of high-temperature granites, such as the Yeoval and Gumble Granites (distinguished by their large magnetic haloes), could be especially prospective. In some areas, the skarns contain other minerals which may also have economic potential, such as garnet and molybdenite (e.g. Yetholme), garnet (Jeremiah Creek), or scheelite and base metal mineralisation (Attunga) (Figure 30).

The Jeremiah Creek deposit, near Burrinjuck Dam (south of Yass) is also a skarn, and contains white marble, wollastonite and garnet. The wollastonite is coarse-grained and in places is massive. However, access to this deposit is difficult owing to the rugged terrain and its relatively remote location.

Nature and Occurrence

Wollastonite is a calcium silicate ($CaSiO_3$) that is formed by the contact metamorphism of siliceous limestone or, less commonly, by the hydrothermal alteration/silicification of carbonate rocks. It also occurs in carbonatite, but deposits of this type have not been commercially exploited.

The formation of wollastonite by contact metamorphism requires temperatures of about 600°C at low pressure, but much higher temperatures at depth (up to 950°C). Deposits are thus mainly restricted to the contact aureoles of high-temperature intrusions.

World Production

World production of wollastonite in 2004 was estimated to be 550 000 to 600 000 tonnes (Virta 2004). About 300 000 tonnes of this production came from China, 176 000 tonnes from India, 115 00 tonnes to 127 000 tonnes from the USA (estimate) and 51 000 tonnes from Mexico. In addition, small amounts were produced in Finland, Morocco, Namibia, North Korea, Pakistan and Turkey.

The settings of deposits on a world wide basis are similar. Wollastonite characteristically occurs in contact-metamorphosed carbonate-bearing sequences in older cratonic areas (Harben & Kužvart 1996).

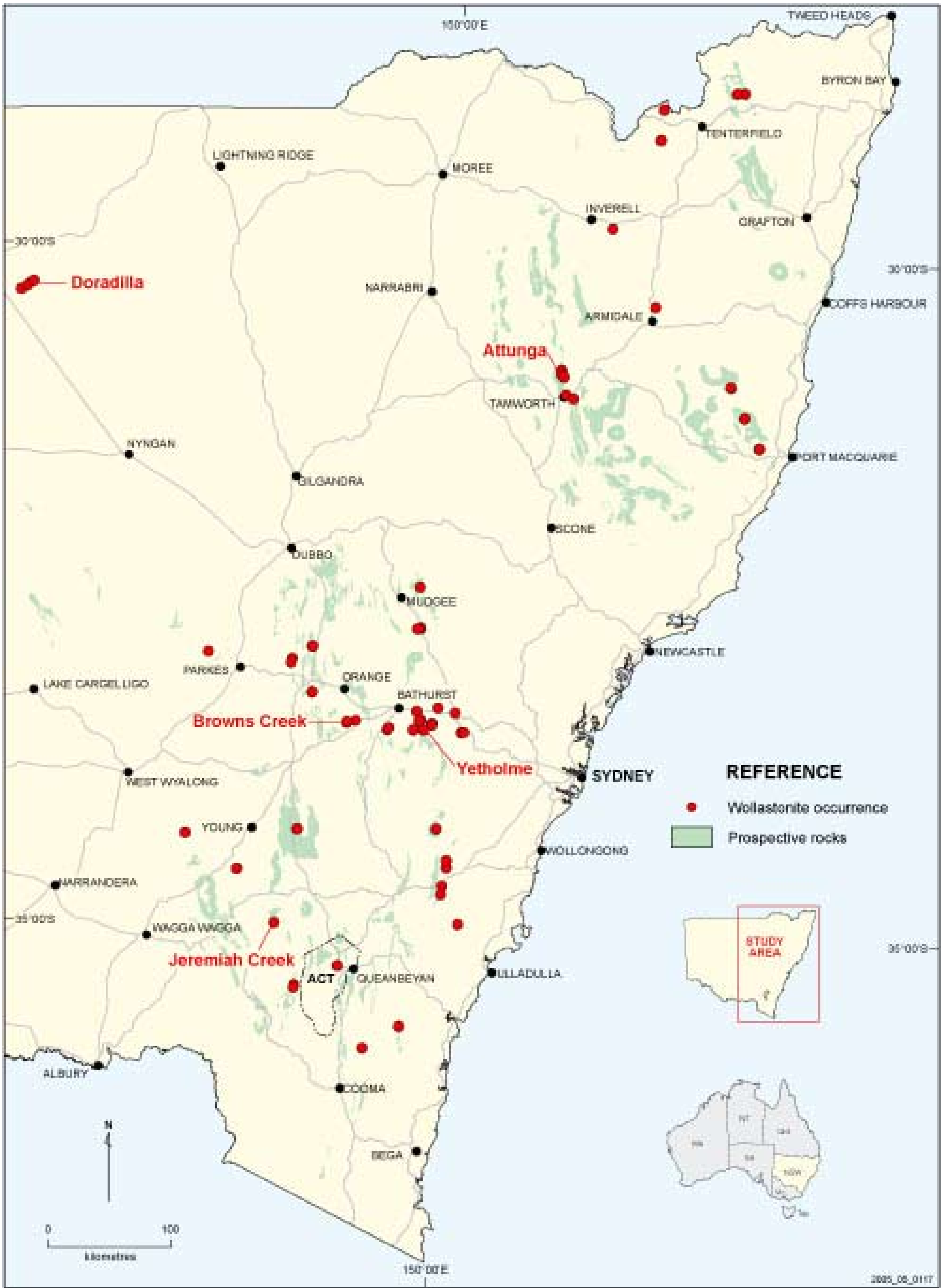

Figure 30. Wollastonite occurrences and prospective rocks in eastern New South Wales

Main Australian Deposits

Wollastonite deposits are known in several other states in Australia, but no production has been recorded. Resources of approximately 600 000 tonnes have been identified in a deposit at the Lady Katherine mine in Queensland (Minerals Corporation Limited 2001). A wollastonite resource exceeding 1 Mt containing more than 40% wollastonite has been defined in the Ethuidna deposit, northeastern South Australia (Crooks 1999). The deposit occurs as deformed diopside marble in the Willyama Supergroup and formed in response to the contact metamorphism of impure limestone by an intruding granite almost 1600 Ma ago.

New South Wales Occurrences

Few of the 63 known occurrences of wollastonite in New South Wales have been investigated for their economic potential (Ray et al. 2003). The significant numbers of wollastonite-bearing skarns in New South Wales (Figure 30), together with the presence of suitable geological settings, suggest that there is moderate to good potential for wollastonite in the state (Malloch 2004).

One occurrence that warrants particular attention is the Doradilla tin–copper deposit near Bourke (Figure 30). The origin of this deposit is uncertain, but it is (essentially) a skarn with significant amounts of wollastonite and also fluorite as gangue to the metallic mineralisation. The deposit averages 50 to 80 m wide, has been proven to depths of at least 200 m, and extends over 16 km. Intensive exploration of the Doradilla prospect ceased when the tin price collapsed in 1985, but the economic potential of the wollastonite and fluorite in the deposits has not been adequately evaluated.

Applications

Wollastonite is one of the few industrial minerals which breaks down into acicular cleavage fragments, and is therefore used as a replacement for asbestos in friction and heat-resistant products. Its other important properties include: high brightness; whiteness; opacity; thermal stability; high fusion point; good electrical and acoustic insulation; low moisture and oil absorption; and insolubility. Wollastonite is also a source of SiO_2 and CaO for glass and ceramics.

For the major applications the associated minerals must be removed. Minerals such as garnet and diopside, which are common in skarns, can be removed by magnetic separation, and carbonate minerals by flotation. The larger of the deposits that are in production contain more than 60% wollastonite, but grades as low as 25% are worked.

A wide range of materials can substitute for wollastonite in the major applications, but wollastonite has an advantage because it is often used to supply more than one major component or desired property. In ceramics, calcium carbonate, silica, kaolin and talc may be substituted. Numerous materials are also used as fillers, including barite, calcium carbonate, feldspar, nepheline syenite, silica and, in friction materials, asbestos, barite, bauxite and alumina. Synthetic wollastonite is manufactured in several countries, and competes with natural material in some applications, notably in ceramics and metallurgy.

Economic Factors

Growth of wollastonite consumption has stabilised since 1996 after a period of strong growth between 1970 and 1995 (Virta 2004). Consumption of wollastonite increased significantly in the early 1980s, largely due to its use as a substitute for asbestos in fire-resistant and friction materials, in which it is still important. Subsequently the expansion of consumption in the plastics and ceramics industries has also led to increased demand. However, competition from alternative materials and from synthetic wollastonite is strong.

Health Issues

Because of its acicular nature, concerns about the health hazards associated with the use of wollastonite have been raised in recent years. However, wollastonite is quite distinct from asbestos in its physical and chemical properties, and the mineral is not currently classified as having similar health hazards. Silica and some other minerals associated with wollastonite have recognised health hazards, and may need to be removed.

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