*Photograph 20. Port Kembla blast furnace. Serpentine is used as a flux in steelmaking — during which it combines with impurities in the molten metal. The slag can be used for such high-quality uses as skid-resistant road surfacing, concrete aggregate and embankment fill. (Photographer D. Barnes)*

## Potential and Outlook

Within New South Wales serpentine occurs in several ultramafic belts and complexes (Figure 24). These include the three types summarised below.

- Alpine-type serpentinite belts, including the Great Serpentinite Belt and Gordonbrook Serpentinite Belt in the New England Orogen, and the Coolac Serpentinite Belt in the Lachlan Orogen.
- Alaskan-type complexes (e.g. Tout Intrusive Complex) in the Fifield area.
- Other ultramafic rocks, such as limburgites, associated with the Ordovician volcanic arc rocks of the eastern Lachlan Orogen (e.g. the Rockley Volcanics, which are best developed west of Oberon).

## Nature and Occurrence

Serpentine (Table 36) is a soft, green, grey, yellow or white, Mg-rich phyllosilicate with the general formula $Mg_3[Si_2O_5](OH)_4$ tri-octahedral with a characteristic basal spacing of 0.7 nanometre (Deer et al. 1992).

The main types of serpentine are: chrysotile (fibrous); lizardite (platy); and antigorite (elongate, and known as picrolite when fibrous). Chrysotile in fibrous form is the most common form of asbestos. Because serpentinite often has some asbestos, its use for such applications as a construction material in unpaved road surfaces is restricted. Although some serpentinite minerals are fibrous, all have a kaolin-like structure. Serpentine differs from kaolin minerals, however, in being trioctahedral, and in the stacking of their fundamental layers.

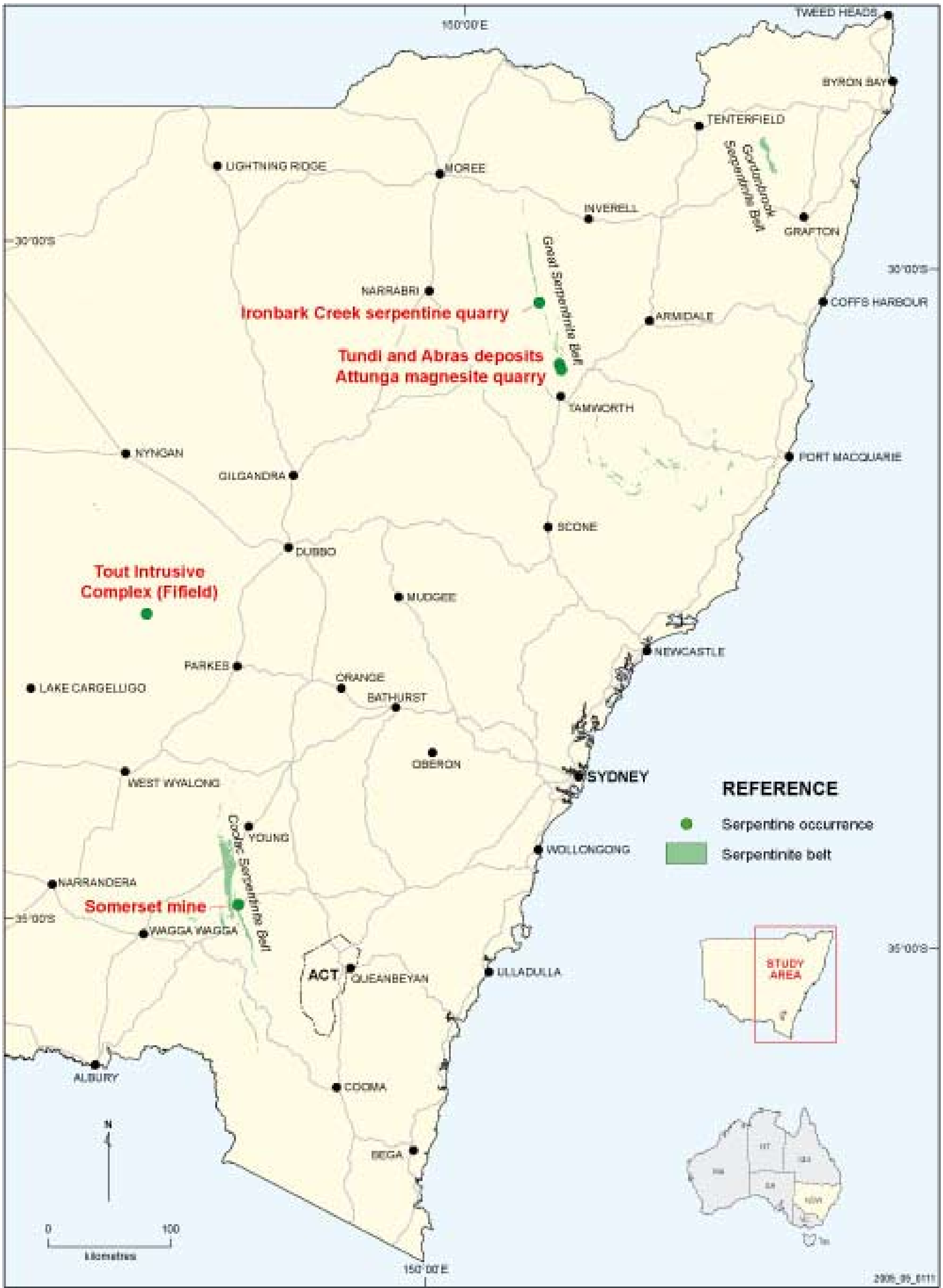


*Figure 24. Serpentine occurrences and prospective ultramafic rocks in New South Wales*

| Table 36. Main properties of serpentine | |
|---|---|
| **Formula** | $Mg_3[Si_2O_5](OH)_4$ |
| **Colour** | Green, yellow or white |
| **Specific Gravity** | 2.55 |
| **Hardness** | 2.5 |
| **Habit** | Compact masses are most common but can be platy, fibrous or asbestiform |

Source: Deer et al (1992)

## Deposit Types

Serpentine minerals are the major constituents of serpentinite, which typically forms through hydration (serpentinisation) of ultramafic rocks. Serpentinite is most common as an alteration product in Alpine-type and Alaskan-type ultramafic complexes and serpentine minerals are the most common products.

## New South Wales Occurrences

Serpentine has been mined from several Alpine-type serpentinite deposits in eastern New South Wales, including the Somerset Mine in the Coolac Serpentine Belt (Figure 24) (Ambler 1984); and the Ironbark Creek serpentine quarry, Attunga magnesite quarry and Tundi deposits in the Great Serpentinite Belt of the New England Orogen.

The Somerset Mine, near Gundagai in southern New South Wales, is currently supplying crushed serpentinite for use as a slag conditioner for iron sinter in basic oxygen steelmaking. Production is about 80 000 to 100 000 tpa.

The Attunga magnesite quarry near Attunga and the Ironbark Creek serpentine quarry near Barraba historically supplied serpentine and magnesite for use in the manufacture of refractory bricks. The Tundi deposit and Abras deposit near Attunga in northern New South Wales have supplied fine decorative aggregate. Material from Tundi was specifically used for roofing materials.

## Applications

Serpentine (from serpentinite) can be used in blast furnaces (Photograph 20). The Ironbark Creek serpentine quarry and the Attunga magnesite quarry have been used as a component of refractory magnesite–serpentinite bricks in steelmaking.

Serpentinite from the Somerset serpentine mine has been used as a slag conditioner for processing iron sinter in basic oxygen steelmaking (Ambler 1984). Detailed specifications are not known, but the material supplied is crushed to less than 5 mm.

Olivine and asbestiform serpentine (chrysotile) tailings are possible alternative materials for use in processing iron sinter, the former being anhydrous and the latter because the material has already been mined.

Decorative aggregate obtained from serpentine at the Tundi deposit has been used for coating roofing tiles.

## Economic Factors

Information on world usage of serpentinite is not readily available. The United States Geological Survey, for example, does not directly publish data on serpentinite production. In 2002, estimated world production of serpentinite was 3.0 Mt, the most important sources being Russia (750 000 tonnes) and Canada (340 000 tonnes) (Harben 2002). Ambler (1984) reported that about 500 000 tonnes were imported to the Port Kembla steelworks from Japanese sources between 1976 and 1983.

Owing to the ready availability of serpentinite resources, the delivered price of bulk serpentinite products is relatively low. Transport would therefore be a major component of the final price, favouring deposits close to markets or those able to access cheap bulk transport. Health issues associated with its use are a potential concern.

## References

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