



NSW DEPARTMENT OF  
**PRIMARY INDUSTRIES**

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## Potential and Outlook

Chlorite is a low-value commodity and its industrial use depends upon development of potential markets based on available supplies. In New South Wales there has been little direct exploration for, or production of, chlorite and the potential for its development is unknown. The historic Cobargo deposits in southern New South Wales were small, and the white chlorite (clinocllore) produced was misidentified as pyrophyllite and talc. Whether Cobargo-type or other chlorites would be commercially acceptable is unclear. Currently there is no identifiable market for chlorite.

The Cobargo deposits are developed in the eroded, Early Devonian Bega Granite close to the unconformable base of the Middle to Late Devonian Boyd Volcanic Complex. Pyrophyllite is widely developed in felsic volcanic units of this complex through epithermal alteration (Herzberger et al. 1978). Chlorite development is attributed to Mg-metasomatism of a minor, late, albite-rich phase of the Bega Granite (Lewis et al. 1994).

Chlorite also occurs widely in low-grade metamorphic belts in New South Wales and such rocks might also have potential as commercial chlorite sources. Whether or not the typically aluminous chlorite of such environments would be commercially acceptable is unclear.

## Nature and Occurrence

The term chlorite refers to a family of phyllosilicates with the general formula  $(\text{Mg,Al,Fe})_{12}[(\text{Si,Al})_8\text{O}_{20}](\text{OH})_{16}$  (Table 6). Chlorite occurs extensively as a result of hydrothermal alteration or low-grade metamorphism. The only chlorite species known to have been exploited commercially is clinocllore, a magnesium-rich chlorite.

The Antler mine in the USA was the only relatively recent producer of chlorite in the world. The mine opened in 1976 and closed in 1992. Total life-of-mine production from this deposit amounted to about 227 000 t. The chlorite was primarily used in ceramic and paint applications. The ore consists of green, fine-grained magnesian chlorite (variety clinocllore), resembling talc. This occurs in veins ranging up to 9 m thick. The veins were formed by replacement of Precambrian (Archaean?) quartzofeldspathic gneiss along near-vertical faults by magnesium-rich hydrothermal fluids, probably related to the Proterozoic talc-forming event in southwestern

Montana. Associated sericitic envelopes surrounding the chlorite deposit also formed during this event.

## Main Australian Deposits

The only known Australian production was from hydrothermally-altered deposits at Cobargo in southern New South Wales.

## New South Wales Occurrences

The Cobargo chlorite was formed by hydrothermal alteration of late-stage albitic stocks and dykes in the Early Devonian Bega Granite. Magnesium-bearing solutions produce white chlorite in these stocks and dykes with the general formula  $\text{Mg}_5\text{Al}(\text{Si}_3\text{Al})\text{O}_{10}(\text{OH})_8$  (Whitworth 1955; Loughnan 1957, 1960; Gemuts 1967). The ore contained 85–95% chlorite and minor talc, albite, vermiculite and/or sericite.

Chlorite production from the Cobargo deposits amounted to about 10 000 t between 1938 and 1975. The minor scale of later production (typically about 400 tpa) was governed partly by limited domestic demand and partly by the small size of the deposits.

Although chlorite is widespread, potentially exploitable chlorite occurrences may need to be of a magnesium-rich variety. This variety may be restricted to environments such as at Cobargo, where Mg-rich (and presumably Fe-poor) solutions interacted with Fe-poor, feldspathic igneous rocks. The generation of Mg-rich solutions would require fluid interaction with an Mg-rich reservoir, such as seawater, ultramafic rocks, Mg-carbonates, brines or evaporites.

**Table 6. Main properties of chlorite**

<b>Formula</b>	$(\text{Mg,Al,Fe})_{12}[(\text{Si,Al})_8\text{O}_{20}](\text{OH})_{16}$
<b>Colour</b>	Green, less commonly white, yellow, pink red or brown
<b>Specific gravity</b>	2.6–3.3
<b>Hardness</b>	2–3
<b>Habit</b>	Scaly or massive aggregates, or large crystalline blocks with perfect basal cleavage yielding flexible but inelastic basal laminae
Source: Deer et al. (1992)	

In New South Wales there are two broadly prospective tracts of potential rocks.

- Marine or near-marine volcanic rifts (e.g. Silurian and Devonian rifts in the Lachlan Orogen) where appropriate hydrothermal interactions could have occurred between seawater (or seawater-derived formation waters) and felsic igneous rocks.
- Ultramafic belts (e.g. Coolac Serpentinite Belt, Great Serpentinite Belt) where fault zones might have facilitated hydrothermal interaction with felsic rocks.

## Applications

Chlorite, which is rarely used industrially, is a relatively low-value material that is mostly exploited in places only where it is locally abundant. Chlorite has replaced pyrophyllite as industrial filler material to a minor extent, and it may have catalytic properties (Murray 1994).

The Cobargo chlorite has successfully substituted on a limited scale for pyrophyllite as filler material in rubber and plastic manufacture and for talc from steatite bodies and as a dusting agent (Whitworth 1955; Loughnan 1960).

Specifications for chlorite are unknown, but those used for pyrophyllite or talc would probably be applied.

The greater hardness of chlorite ( $H = 2.5$ ) compared to pyrophyllite or talc ( $H = 1$ ) could restrict its wider commercial acceptance.

## References

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