STRUCTURAL SETTING OF KIMBERLITES IN SOUTH-EASTERN AUSTRALIA

K.J. Stracke (Stockdale Prospecting Limited, 500 Collins Street, Melbourne, Victoria, 3000, Australia).
John Ferguson (Bureau of Mineral Resources, Post Office Box 378,
L.P. Black Canberra City, A.C.T., 2601, Australia).

Fourteen areas of kimberlite and kimberlitic rocks have recently been discovered in south-eastern Australia in the States of New South Wales, Victoria, Tasmania and South Australia (Fig. 1). One or more intrusives are found in each area with a maximum of twenty seven (see also Ferguson and Sheraton, this volume). Rb-Sr dating on whole-rock samples and on phlogopite separates have established Permian, Jurassic and Cainozoic ages for kimberlitic occurrences in north-western New South Wales, South Australia and south-eastern New South Wales, respectively. Field relations indicate that most of the occurrences post-date the Precambrian and that some are as young as Quaternary.

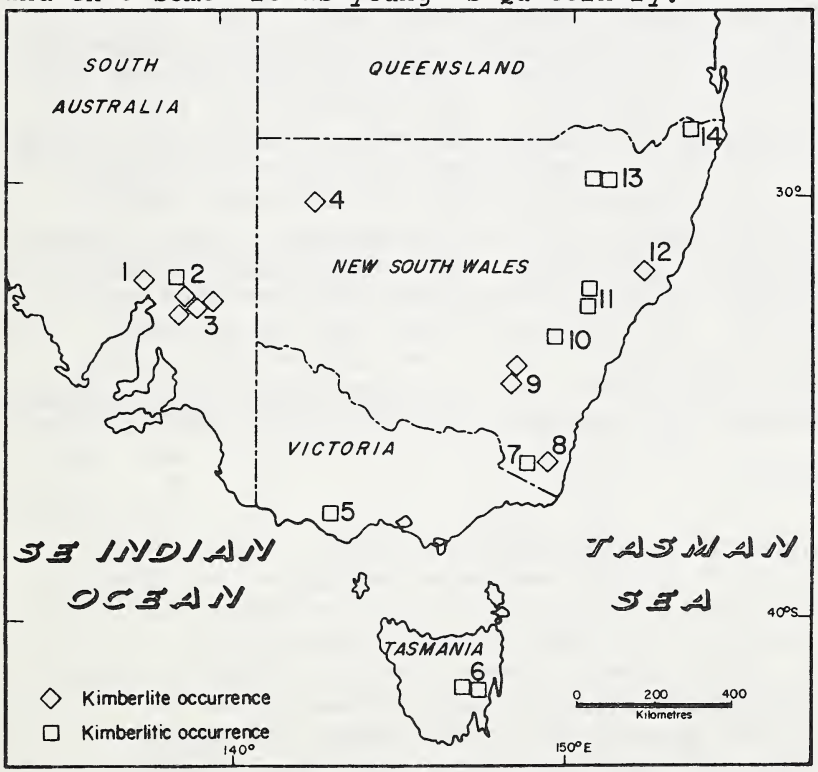

Fig. 1

1 Port Augusta
2 Walloway
3 Terowie
4 White Cliffs
5 Bullenmerri
6 Oatlands
7 Delegate
8 Bombala
9 Jugiong
10 Abercrombie
11 Nullo Mtn.
12 Gloucester
13 Bingara
14 Mt. Brown

In an attempt to relate the kimberlites and their associated rock types to a structural framework the following features were investigated: on- and off-shore structures, igneous activity, earthquake activity, general tectonics, gravity and magnetics.

Two prominent belts of earthquake activity are found in south-eastern Australia, one striking north to north-west through the Flinders Range of South Australia and extending to the north-west margin of the continent; the second belt trends north through Tasmania, across Bass Strait into Victoria, and then north-eastwards into New South Wales, and proceeds offshore in south-eastern Queensland. Cleary and Simpson (1971) have postulated that these two zones of earthquake activity correspond to projected continental extensions of oceanic transform faults originating from the Antarctic Ridge. The separation of Australia from Antarctica commenced 55 m.y. ago and is continuing to the present day (Weissel and Hayes, 1972). Nine of the areas lie on or adjacent to the projected continental extension of these oceanic transform faults.

As indicated by Cleary and Simpson (1971), the edge of epeirogenic uplift on the south-eastern seaboard of Australia, is roughly coincidental with recent earthquake activity, and in consequence, with the projected oceanic fracture zone stemming from the Antarctic Ridge. All of the kimberlite and kimberlitic areas on the south-eastern seaboard of Australia straddle the edge of this epeirogenic uplift which commenced in the Mesozoic and continued intermittently through the Cainozoic (Wellman and McDougall, 1974). Cainozoic basaltic activity is associated with this epeirogenic uplift, occurring in an approximately 300 km-wide zone which incorporates all of the kimberlite and kimberlitic areas on the south-eastern seaboard of Australia. This basaltic activity is dominantly alkaline but in two of the areas the immediate rock types are sub-alkaline. The Cainozoic mean line of hot spot migration (Wellman and McDougall, 1974), as defined by central volcano provinces and the present day hot spot sites (Sass, 1964), also passes through the zone of basaltic activity in south-eastern Australia. Areas 9, 10, 11 and 14 lie on or near this mean line of hot spot migration.

Following on the hypothesis, developed by Wilson (1965), that lines of old continental crustal weakness determine the sites of transform fault development, Ringis (1975) established that this concept has application to the south-eastern Australian continental margin. Here igneous events can be related to zones of pre-existing continental weakness that became sites of reactivation during the opening up of the Tasman Sea which commenced 80 m.y. ago and aborted 60 m.y. ago. Kimberlitic development also appears to have been governed by zones of weakness, developed during pre-breakup times, which later became the sites of continental extensions of transform faulting during Tasman Sea opening.

There is no clear-cut relationship between kimberlite and kimberlitic rocks and the distribution of granitic rocks or general tectonic units; magnetic coverage is too sketchy to draw conclusions. Thirteen of the areas occur in gravity lows and there is a broad parallelism between the trends displayed by gravity, tectonic units and granitic belts.

It is concluded that postulated continental extensions of transform faults, stemming from both the Antarctic and Tasman Sea Ridges, appear to have played the major role in the location of kimberlite and kimberlitic intrusives in south-eastern Australia.

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