The Palaeogeographic Significance of Local Endemism in Tasmanian Higher Plants

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There are seven centres of local higher plant endemism in Tasmania. The locations of the strongest of these centres are consistent with current ideas relating to the Quaternary environmental history of the state.

The concept of equiformal ranges (Hulten, 1937) suggests that groups of species with generally similar geographically restricted distributions are likely to occur in environments that may have been more widespread in the past. For example, the distributions of alpine species, except for any recently evolved, must have repeatedly expanded and contracted in response to recurring glacial cycles. During interglacial periods they would have equiformal recessive ranges (Daubenmire, 1975) and at the onset of glacial periods they would exhibit equiformal progressive ranges (Hulten, 1937). Over a cycle of glaciation they would exhibit equiformal oscillating ranges (Kirkpatrick and Brown, 1984). It should be possible on this basis to use present-day distributional evidence to test theories of past environmental change.

While undertaking the mapping of the distribution of all Tasmanian endemic higher plant taxa (Brown et al., 1983) and a numerical analysis of the endemic flora (Kirkpatrick and Brown, 1984) we became aware of the high degree of geographic restriction of many taxa. The present paper attempts to determine whether these restricted endemics exhibit patterns of equiformal ranges and to examine their possible palaeogeographic significance.

To determine the distribution of restricted endemics we used the 10 x 10km grid records in Brown et al. (1983), defined a geographically restricted species as one with both a north-south and east-west extent of no more than 100km (cf. Leigh et al., 1981) and counted the number of restricted species in each grid square. Endemic subspecies (but not varieties) were included in the analysis.

A chi-square test of the goodness of fit to a Poisson series showed that the distributions of the restricted endemics are highly contagious ($\chi^2 = 460.8, p < 0.001$) i.e. there is a pattern of clumps or centres of local endemism. In proceeding to identify these centres, we modified our

TABLE I

Occurrence of restricted endemic taxa in geographical centres 1-7 (see Figure 1). Authorities for taxa are those given in Brown et al. (1983).

<table>
<thead>
<tr>
<th>Centre</th>
<th>Species as per Figure 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ceratopetalum sp. nova, Epacris bartsii, Vaccinium sp. nova, Genus talbotianum, Haemodoraceae distichophylla, Lomatia tasmanica, Myrtus johnsonii, Senecio papillosus, Senecio primulofolius, Sprengelia distichophylla, Trachypoma distichus</td>
</tr>
<tr>
<td>2</td>
<td>Acacia pataczezii, Epacris barbata, Eucalyptus barteri, Epacris collina sp. dufresnei, Helichrysum keyserlingii, Lantana pyrocarpa, Lomatia tasmanica, Melaleuca sartori, Pultenaea sp. sartori</td>
</tr>
<tr>
<td>3</td>
<td>Capsella seminacea, Centrolepis maculata, Cynodontis nitida, Eucalyptus cherriei, Epacris gibbosa sp. microphylla, Gossia cordifolia, Isopetalus sp. nova, Melaleuca sartori, Olearia sartori, Pultenaea sartoria, Rhamnus seminacea, Scrophularia seminacea, Stenocarpus seminaceus</td>
</tr>
<tr>
<td>4</td>
<td>Caladenia atkinsonii, Eucalyptus morihiby, Eucalyptus riddiana, Epacris gibbosa ssp. sandpinetorum, Monotoca latifolia, Prasophyllum comosum, Senecio sartori</td>
</tr>
<tr>
<td>5</td>
<td>Epacris sartoria, Pimelea fimbriata, Tetratheca sartoria</td>
</tr>
<tr>
<td>6</td>
<td>Epacris sartoria, Epacris vestita, Epacris sartoria, Epacris vestita</td>
</tr>
<tr>
<td>7</td>
<td>Epacris vestita, Epacris vestita, Epacris vestita, Epacris vestita</td>
</tr>
</tbody>
</table>

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FIGURE 1

Centres of local endemism (numbered) and the distributions of local endemics outside these centres. Grid squares containing more than two local endemic taxa are marked by a medium sized dot. Grid squares containing more than two local endemic taxa and with these taxa having in total a score greater than 5 using the weighting described in the text are marked by a large dot. The distributions of those local endemics that do not occur at least partly within a centre of local endemism are shown by crosses.
distributions, but are confined to those relatively few places in the Tasmanian high country where soils are deep and largely free of rocks (Kirkpatrick, 1983). The depression of temperatures during the Last Glacial would have vastly extended the area with low summer temperatures and deep rock-free soils.

Geomorphic and palynological evidence has strongly suggested that effective rainfall during the Last Glacial was less in eastern Tasmania than at present (Sigler and Colhoun, 1981; Bowden, 1983). The centre of local endemism at Great Oyster Bay, Figure 1) supports this suggestion, as it occupies the presently driest part of the east coast. Centre 4 at Hobart, also supports this suggestion, as the alpine area of Mt Wellington receives the least rainfall of any mountain in the state and the eastern shoreline of the Derwent is a strong local rainshadow. Nevertheless, the observed concentration of local endemics at Hobart may be partly attributable to its concentration of botanical collectors and taxonomists, especially in regard to the eucalypts and orchids.

The influence of relative density of collecting on the distribution of local endemics can also be imputed in the cases of the Tasman centre (6) and Mount Field (7). In the case of the Tasman Peninsula, the combination of a relatively fertile substrate, a high-energy coastal environment and high rainfall may not have been more extensive in the past than at present. The Tasman local endemics have not differentiated far from their local relatives, two of the three species involved being only recently described (Barker, 1982) in a genus characterised by local endemics. The three Mount Field taxa are also recently recognised, two at the subspecific level. Two of these taxa are likely to be found much more widely as collectors become accustomed to their differentiation.

The remaining centre of local endemism (5) is strongly associated with the ultramafic rocks of the Dazzler Range. The species involved may have evolved before the Last Glacial. If they did so they presumably occupied the same geological habitat during the cold and continental conditions that prevailed when Bass Strait was dry land. Thus, they could be expected to be able to tolerate much lower temperatures than prevail at present.

The patterns of local endemism in Tasmania are largely consistent with present perceptions of the Tasmanian environment during the Last Glacial and offer the opportunity for experimental verification of past climatic conditions in the case of the Dazzler Range endemics.

References


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Minimum Age for Desert Varnish in the Broken Hill Area, NSW: A Preliminary Estimate

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A manganese-rich varnish appears on fine-grained sandstone to the north of Broken Hill. Aboriginal rock engravings in the area have varnish coatings apparently similar to those on adjacent rock surfaces; in the absence of varnish redistribution, it is assumed that the period of varnishing postdated the engravings. A radiocarbon date of 7000 ± 310 years BP (SUA 113) was obtained for calcium carbonate which partly encased a varnished stone. A conservative, corrected age for the carbonate would suggest a minimum of 5290 years for the engravings.

Desert varnish in the Eight Mile Creek area (80 km north of Broken Hill) is a thin, shiny, dark reddish-brown to mainly black coating on the upper surfaces of many outcrops and loose stones. Aboriginal engravings frequently appear on the more varnished varnished surfaces, varnish coatings apparently similar to their adjacent rock surfaces. Because of these similarities, it is assumed that the phase of varnishing occurred either during or after the period when engraving took place. This note provides an estimate of the minimum age of varnished rock which, although reported a preliminary result based on one sample, is of interest in the absence of reported dates for varnish in Australia and the importance of varnish as an age indicator for aboriginal rock art.

Anthropologists generally believe that varnished engravings indicate considerable, if indefinite, age (for example, Mountford and Edwards, 1963; Mountford, 1971; Bard et al., 1978; Butzer et al., 1979). At the Eight Mile Creek site, assessment of rock art technique (pecking or indirect percussion) and motif (predominantly representations of tracks and nonfigurative designs) has led to the engravings being designated 'Panaramitee Style', for which minimum ages of 5000 to 7000 years have been proposed (Maynard, 1979). A typology of these engravings is being developed by Clegg (1982) for comparing this rock art with that at other nearby sites. Apart from the date reported here, no age has been established for varnish or engravings at the Eight Mile Creek site.

FIGURE 1

Location of carbonate-covered stone in relation to varnished and engraved rock surfaces within a portion of the Eight Mile Creek site: based on a map (approximate only) provided by J. Clegg, University of Sydney, who made tracings of engravings on all individual mapped outcrops.

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