Paleoenvironmental investigation of Caladenia Cave fossil mammals: consolidating Holocene climate change patterns in southwestern Australia *

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Quaternary paleoenvironmental research on the Swan Coastal Plain of Western Australia has focused primarily around Perth and the extreme southwest, with very little work conducted to the north between 29° and 32° S. Marine invertebrates in the Swan River, calcrete deposits along the coast, previously worked vertebrate cave assemblages and fossil pollen floras pulled from swamps on Rottnest Island and in the extreme southwest provide evidence for an increase in rainfall during the mid to late Holocene, but are chronologically inconsistent. Many of these records used multiple sites and concluded with one chosen site and date as evidence of regional climate change. Other dates such as those for Rottnest Island are highly specific to a single location, an island environment being climatically isolated from the mainland, but assumed to represent greater coastal southwestern Australia. Many of these investigations also use various incompatible dating methods across marine and terrestrial environments where the dates have not yet been calibrated.

Using fossil mammal remains excavated in the 1970s from Caladenia Cave (EM-17) in the East Moore cave area, 100 km north of Perth, this investigation explores the communities of the Caladenia Cave District between 7000 BP and the present. Climate change events were found to be in chronological synchronisation with newly calibrated records to the north and south on the Swan Coastal Plain. A loss of the species characteristic of semiarid and arid regions such as *Phascogale calura*, *Perameles bougainville* and *Lagorchestes hirsutus* indicates an increase in rainfall around 4.7 ka (cal. BP). This increase when mapped spatially with previous records mentioned above show a pattern in the timing of an increase in effective precipitation, in the mid to late Holocene, moving north and inland from the coast according to the orographic effects of the Darling and Gingin Scarps. A change to small sieve-mesh aperture at a late stage of the excavation created a sample-based bias, towards species with larger remains, preventing a statistically significant paleoecological interpretation. This bias has been previously recognised and termed 'differential recovery' due to its selection of certain species based on the size of their remains. Correspondance analysis of the minimum number of individuals from the assemblage showed this bias has had a strong influence on the faunal abundances. The relative abundance data were normalised by sample in an attempt to accommodate the differential recovery of identifiable remains. The output of a principal components analysis then grouped the small mammal species of the Caladenia Cave core assemblage by a primary factor that appears to be substrate related, but no significant interspecies relationships could be determined. This result is similar to previous conclusions from an analysis of Hastings Cave in Jurien Bay to the north on the Swan Coastal Plain. Substrate areas have remained relatively unchanged in the Caladenia Cave District during the Holocene, the dune systems having been deposited during the Pleistocene.

Experiments into a quantifiable measure of the effects of differential recovery will be explored at a later date, as this proved to be of major detriment to this research. The implications of these results may include the suggestion of standardisation of sieve mesh apertures across paleontological and zooarcheological excavations.

Future research on the wider Swan Coastal Plain using similar techniques to match cave surface fossil mammal relative abundances to local substrate areas should elucidate the paleocommunities, eliminating the need for resource-intensive excavations. The presence of now locally extinct small mammals in the upper layers of the Caladenia Cave deposit are indicative of the pre-European fauna on the northern Swan Coastal Plain. The Moore River National Park, located less than 10 km from Caladenia Cave, presents an excellent opportunity for reintroduction of these species and rehabilitation of the original vegetation formations. With most of the land on the northern Swan Coastal Plain cleared for urban development and agricultural purposes, the National Park is a well-located sanctuary for each of the substrate-based communities elucidated from this research. With greater investment of funding and labour into the management of the park, this area would be an excellent conservational resource for the biodiversity hotspot of southwestern Australia.

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