VICARIANCE, DISPERSAL AND THE STRANGE CASE OF THE TASMANIAN BLACK NERITES

Simon Grove

25 Taroona Crescent, Taroona, Tasmania 7053. email: groveherd@bigpond.com

I know them as black nerites. Others call them crows. These solid snails, jet-black on the outside and porcelain white on the inside, will be familiar to many who delight in exploring Tasmania's rocky shores. Nerites form a large group of mostly intertidal gastropod molluscs. Tropical shores may host a dozen species in a range of colours, sizes, shapes and textures, but up to now, we poor souls in the Far South have had it easy, with only a single, sombre-coloured species recognised.

Reeve described *Nerita atramentosa* from Western Australia's Swan River in 1855, while E.A. Smith formalised the name *N. melanotragus* for New Zealand specimens in 1884. Ever since, taxonomists have vacillated between calling the southern Australian nerites *N. atramentosa* and *N. melanotragus*: I opted for the latter in a recent Tasmanian checklist (Grove *et al.* 2006).

Now, it seems, taxonomists can have it both ways. It transpires that there are actually two black nerite species in the region, and both occur in Tasmania. *Nerita atramentosa* could be dubbed the western black nerite (or, with an eye to research sponsorship, the Adelaide crow?). It's the species Reeve described from Western Australia, and on the south coast of mainland Australia dominates as far east as Wilsons Promontory in Victoria. Then there's *N. melanotragus*, the eastern black nerite. It's the only species present in New Zealand and on Lord Howe and Norfolk Islands, and is the dominant species of black nerite in southeastern Australia, from southern Queensland to Wilsons Promontory. How this situation arose makes a fascinating detective story, one that stretches back many thousands of years. It highlights the impermanence of the island entity that we call Tasmania, and gives us a glimpse into the processes of speciation happening on our own doorsteps. The story was recently recounted in a seminar at the University of Tasmania given by Dr Jon Waters, a Tasmanian marine biologist now working in New Zealand.

Without going into the detail, during the last Ice Age, sea levels were much lower than they are today. Bass Strait dwindled to a gulf, connected to the Great Australian Bight to the west but disconnected from the Tasman Sea to the east by a land bridge, the Bassian Isthmus, between what is now north-eastern Tasmania and eastern Victoria. It looks as though an ancestral black nerite once occupied the entire region (with the same or related forms elsewhere in the Pacific as far east as Easter Island), but its southern Australian populations became separated for many thousands of years by the Bassian Isthmus. Nerite larvae are planktonic and can be dispersed long distances by currents during this phase of their life. However, during the Ice Age, water temperatures around southern Tasmania would have been a few degree cooler than today, and apparently presented an insurmountable barrier for nerite dispersal. This allowed the two populations to drift apart

genetically. They may have done this several times as the glacial cycles waxed and waned in succession, but we have no easy means of knowing this. What we do know is the end result: two separate species, arisen through what biogeographers call vicariance. In other words, the nerite populations were responding passively to changes in the landscapes and seascapes around them. (The alternative process that can give rise to speciation, 'boldly going where no nerite has gone before', may account for the distribution and nature of other black nerites in the South Pacific).

But this is not the end of the story. The current interglacial has seen sea levels rise, reconnecting eastern and western Bass Strait. Wilsons Promontory is the last bastion of the Bassian Isthmus, and, formidable though it may be as an obstacle to human mariners, it's hardly going to stop a determined nerite. Furthermore, warmer waters now put the whole of Tasmania's coastline within the habitable range of nerites (though I know of no records from the far southwest, and nerites are rare west of the Tasman Peninsula). As a result, it appears there has been some 'spillover' of each species into the others' domain. The details are described elsewhere (Waters *et al.* 2005), but essentially, while the broad-scale pre-interglacial pattern remains intact, there is an overlap zone centred on Victoria and Tasmania where both species occur. In Victoria, Wilsons Promontory remains the dividing line, either side of which one or other species dominates. Populations of nerites on shores east and west of here are predominantly one species or the other. But the presence of occasional adults of the 'wrong' species suggests the boundary may not be stable in the longer term if dispersing nerite larvae ever get to establish self-sustaining populations beyond their current respective ranges. Whether they do so or not may also depend on the extent to which the two species compete for the same resources. For instance, where they occur together, do they graze the same sorts of algae and prefer the same sorts of rocky microhabitats, or do they find a way of dividing these up, allowing co-existence?

What does this mean for naturalists in Tasmania? It means we can't just call our nerites black, and there's work to be done in understanding the Tasmanian distribution of eastern and western blacks. In principle, either could be found anywhere around our coast, but one would suspect that *N. atramentosa* might dominate along the Bass Strait coast (and west coast?) while *N. melanotragus* might dominate along the east and south coast. Only time and further study will tell.

This all begs the question, how can the two species be told apart? All is made clear in a recent paper (Spencer *et al.* 2007) – at least if you're looking at live nerites. The colour of the snail's operculum or 'front door' - the horny plate attached to its foot - is diagnostic (Figure 1). In *N. melanotragus* it is 'orangey-tan', while in *N. atramentosa* it is black. There are further distinguishing characters on the shells, but these are more subtle and can be obscured in worn specimens. It also helps to have named examples of both species in front of you as some of these characters are 'relative'. For instance, the outer lip of undamaged specimens shows crenulation in *N. atramentosa*, a feature not normally present in *N. melanotragus*. The teeth on the columella and the tooth at the apical end of

the outer lip are all more prominent in *N. atramentosa* than in *N. melanotragus*. More conclusive is the body-whorl sculpture: in *N. atramentosa* it consists of at least 30 spiral cords, whereas these number 15 to 22 in *N. melanotragus*. Finally *N. atramentosa* is, on average, larger and heavier than *N. melanotragus*.

I am interested in collating records of both species as part of a longer-term initiative aimed at producing an atlas of Tasmanian marine molluscs. I would also be happy to look at well-documented nerite material collected anywhere in Tasmania.

ACKNOWLEDGEMENT

Thanks to Jon Waters for checking over a draft of this paper.

REFERENCES

Grove, S.J., Kershaw, R.C., Smith, B.J. & Turner, E. (2006). *A Systematic List of the Marine Molluscs of Tasmania*. Queen Victoria Museum and Art Gallery Occasional Paper No. 8. Queen Victoria Museum and Art Gallery, Launceston.

Spencer, H.G., Waters, J.M. & Eichhorst, T.E. (2007). Taxonomy and nomenclature of black nerites (Gastropoda: Neritimorpha: *Nerita*) from the South Pacific. *Invertebrate Systematics* 21: 229-237.

Waters, J.M., King, T.M., O'Loughlin, P.M. & Spencer, H.G. (2005). Phylogeographic disjunction in an abundant high-dispersal littoral gastropod. *Molecular Ecology* 14: 2789-2802.

Figure 1. Comparative appearance of *Nerita* species. The image shows two live specimens from Piccaninny Point, north of Bicheno.
N. melanotragus is on the left (the dominant species at Piccaninny Point) and *N. atramentosa* is on the right. Note the different colours of the opercula (shown in this figure as shades of grey but see colour plate in centre of volume). Photo: Simon Grove.