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Quaternary climate instability as the driver of genetic diversification in *Neogloboquadrina pachyderma* (sin)

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Molecular genetic analysis shows that many planktonic foraminiferal morphospecies represent complexes of several distinct genetic types with distinct ecologies and distributions. Such cryptic diversity is common in most planktonic protists. Global biogeographical patterns provide many clues to their specific adaptations in the present day but not always to the past processes which may have created them. Planktonic foraminifers are ideal taxa for addressing these issues as their evolutionary history can be traced back in time with high resolution using their outstanding fossil record. In combination with paleoceanographic evidence, it is possible to interpret the modern molecular studies in an historical oceanographic context and gain an insight into the links with past global climatic or tectonic events.

Neogloboquadrina pachyderma (sin) currently dominates the high latitude assemblage and has played a pivotal role in the reconstruction of past climate in these regions. It first appeared approximately 10 million years ago and phylogeographic evidence indicates that it may not have been a true polar adapted morphospecies throughout its existence. The common ancestor of all the modern day *N. pachyderma* (sin) genotypes was bipolar and thus had a subpolar ecology. At the onset of Northern Hemisphere glaciation, Atlantic Arctic and Antarctic populations became isolated and some genotypes developed an extreme polar affinity. Others retained a more subpolar ecology but with a more restricted temperature range than the bipolar subpolar morphospecies. Genetic diversity therefore arose in *N. pachyderma* (sin) through a stepwise progression of diversification associated with the onset of Northern Hemisphere glaciation and the glacial-interglacial climate dynamics of the Quaternary period.