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Periodic isolation of the southern coastal plain of South Africa and the evolution of modern humans over late Quaternary glacial to interglacial cycles

J.S. Compton
University of Cape Town, Geological Sciences, Rondebosch, South Africa (john.compton@uct.ac.za)

Humans evolved in Africa, but where in Africa and by what mechanisms remain unclear. The evolution of modern humans over the last million years is associated with the onset of major global climate fluctuations, glacial to interglacial cycles, related to the build up and melting of large ice sheets in the Northern Hemisphere. During interglacial periods, such as today, warm and wet climates favored human expansion but during cold and dry glacial periods conditions were harsh and habitats fragmented. These large climate fluctuations periodically expanded and contracted African ecosystems and led to human migrations to more hospitable glacial refugia. Periodic isolation of relatively small numbers of humans may have allowed for their rapid evolutionary divergence from the rest of Africa. During climate transitions these divergent groups may have then dispersed and interbred with other groups (hybridization). Two areas at the opposite ends of Africa stand out as regions that were periodically isolated from the rest of Africa: North Africa (the Maghreb) and the southern coastal plain (SCP) of South Africa. The Maghreb is isolated by the Sahara Desert which periodically greens and is reconnected to the rest of Africa during the transition from glacial to interglacial periods. The SCP of South Africa is isolated from the rest of Africa by the rugged mountains of the Cape Fold Belt associated with inedible vegetation and dry climates to the north. The SCP is periodically opened when sea level falls by up to 130 m during glacial maxima to expose the present day submerged inner continental shelf. A five-fold expansion of the SCP receiving more rainfall in glacial periods may have served as a refuge to humans and large migratory herds. The expansive glacial SCP habitat abruptly contracts, by as much as one-third in 300 yr, during the rapid rise in sea level associated with glacial terminations. Rapid flooding may have increased population density and competition on the SCP to select for humans who expanded their diet to include marine resources or hunted large animals. Modest expansion of the coastal plain off Morocco and more extensive expansion off Tunisia would have similarly provided potential refugia for human groups during glacial periods. Other refugia in the African interior included the Ethiopian Highlands and the East African lakes; however, most of these regions probably had more diffuse barriers connected by river valley corridors. The earliest yet reported occurrence of symbolic artifacts from both North Africa and the SCP coastal caves of South Africa suggest that human populations in these areas were under shared selection pressures to adapt to increasing population densities associated with the transition from Marine Isotope Stage (MIS) 6 to 5, 135 to 130 thousand years ago. The hypothesis that periodic expansion and contraction of the coastal plains of South Africa and North Africa contributed to the stepwise origin of our species over the last 800 thousand years is evaluated by comparing the archeological, DNA and sea-level records.