Forum Comment

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A climatic context for the out-of-Africa migration

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The paper by Tierney et al. (2017) on the climatic context of the out-of-Africa migration provides some extremely valuable data for the time frame when this migration took place. While the data set provided is impressive, the interpretation and significance of that palaeoproxy dataset to the cause/effect of human exodus from Africa may have an alternative explanation.

The first concern is the use of the language of "push" and "pull" forces that Tierney et al. say species are subject to. "Push" implies that a population expands out of an area because of a deteriorating environment in that area. On the other hand, "pull", which Tierney et al. claim is the more commonly occurring process in ancient migrations, suggests that a population moves toward an area with better conditions. They cite a paper showing that "push" is more common in human migrations today (Warner et al., 2010), but they give no citation for ancient human migrations when they say "pull" would have dominated. It is hard to conceive how "pull" could take place in the deeper past, as it requires the pre-existence of populations outside of Africa and a means of communicating between the two populations to exert a "pull." Thus, how "push" and "pull" factors would work in ancient humans is unclear—an explanation of how both "push" and "pull" factors would affect ancient humans' range expansion out of Africa would have been useful. Expansive range change is usually conceived of as involving population growth during times when an organism's preferred conditions improve and expand due to habitat tracking (Fenberg et al., 2014; Mair et al., 2014). There is no reason to suppose Palaeolithic humans would have responded differently (Stewart and Stringer, 2012).

If indeed the move out of Africa by humans was an expansion, as generally conceived by biogeographers, the cold/dry climates in Africa may well have been a challenge to survival, as suggested by Tierney et al. The palaeoproxy data may therefore signify that the climate at the time of the out-of-Africa movement was not optimal for population growth with corresponding range expansion. However, the paper mentions the "southern route" involving the maritime/coastal corridor northward along the East African coast (Armitage et al., 2011; Petraglia et al., 2010; Reyes-Centeno et al., 2014; Stringer, 2000) which is an alternative to the "northern [terrestrial] route" through the Sahara and into the Levant. There is evidence for population growth in coastal modern humans at around the time of the out-of-Africa migration, as seen by their apparent greater impact on shellfish sizes in South Africa (Klein and Steele, 2013). Maritime conditions may not be as badly affected by the cold and dry climatic conditions revealed by the climate proxy data (Tierney et al., 2017). This is because cold marine conditions can be more productive than warm marine conditions, particularly if there is upwelling (Bakun et al., 1998). It is interesting, therefore, to note the upwelling zones of the Somali Current along the east coast of Africa up to Arabia (Thompson, 1978). It would be useful to understand the temporal relationship between sea-surface temperature (SST) changes and the intensity of upwelling (and production) on the east coast of Africa; particularly in light of the new evidence Tierney et al. present showing a clear dip in SST around the time of the presumed out-of-Africa expansion.

If marine conditions improve during cold times, then the anatomically modern human (AMH) populations in those habitats are likely to have grown. If the populations grew, they would have expanded, and because the coast is a relatively linear environment, the expansion would have been rapid (Armitage et al., 2011; Petraglia et al., 2010; Reyes-Centeno et al., 2014; Stringer, 2000). So the apparent contradictions in the climate at the time of the African exodus may imply that the "southern route" was most likely, rather than requiring a non-conventional mechanism (i.e., "push" and "pull" factors) for the "northern route." The possibility exists, therefore, that there is an alternation between out-of-Africa migration being coastal during cold episodes and through the green Sahara during warm episodes. The latter may be the scenario for the ultimately failed expansion of AMH during Marine Isotope Stage 5 evidenced by their remains in the Levant (Grün et al., 2005).

What is not clear, however, is how the coastal route becomes eventually translated into a means of spreading into terrestrial parts of Eurasia, although it is tempting to invoke large river corridors.

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