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Ages, durations and behavioural implications of Middle Stone Age industries in southern Africa: advances in optical dating of individual grains of quartz

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Recent developments in OSL dating have focussed on the measurement of individual sand-sized grains of quartz. Single-grain dating allows the identification of contaminant grains in a sample and their exclusion before final age determination, and the ability to directly check the stratigraphic integrity of archaeological sequences and address concerns about post-deposition sediment mixing. These benefits result in single-grain OSL ages being both accurate and precise. Even greater precision can be attained by adopting a systematic approach to the collection and analysis of OSL data. This involves one operator using the same OSL stimulation and detection instrument, laboratory radiation sources, calibration standards, and analytical procedures for all samples. By holding these experimental parameters constant, sources of error common to all samples are removed, enabling far greater resolution of the true age structure. This approach was recently used to determine the timing and duration of two bursts of Middle Stone Age technological and behavioural innovation – the Still Bay (SB) and Howieson's Poort (HP) – in southern Africa. These distinctive artefacts are associated with the first evidence for symbols and personal ornaments, and may have been the catalyst for the expansion of Homo sapiens populations in Africa 80,000–60,000 years ago and for the subsequent migration of modern humans out of Africa. Testing such hypotheses, and the putative role of climate change, has been hampered by poor age constraints for the HP and SB industries. Previous attempts to resolve the start and end dates of these industries had been largely obscured by the chronological' haze' arising from a variety of different materials being dated by different methods using different equipment, calibration standards, measurement procedures and techniques of data analysis. By clearing this haze and placing all ages on a common timescale, we were able to constrain the timing of the SB and HP, and the gap between them, to better than 3000 years at the 95% confidence interval. Both industries occur within the interval of population expansions in Africa inferred from genetic studies. A meta-analysis shows that our new ages are consistent with previous estimates but are more precise, revealing a lack of spatial patterning of the HP and SB across varied climatic and ecological zones. We find a temporal coincidence with major swings in climate, but not uniquely with these industries. Environmental factors may, therefore, have been responsible for episodic occupation of rock shelters, but were not the forcing mechanism behind the emergence of modern human behaviour.