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LAST WORD

The Palaeodeserts Project

was Arabia once full of lakes and lush plantlife?

The Palaeodeserts Project has been a regular feature in international archaeology news, with exciting new evidence for wetlands instead of desert. As **Dr. Ash Parton** *now explains, this could have significant impact for our understanding of the movements of human populations out of Africa.*

When you think about Arabia, the images that typically come to mind are those of an intensely arid landscape of endless sand seas and scorching heat, however, it has not always been this way. At various times over the past few hundred thousand years, Arabia experienced prolonged humid periods which transformed the landscape into one littered with rivers, lakes and wetlands. Since the Arabian Peninsula lies at a critical position for the movement of early human populations out of Africa, knowing how and when these humid periods occurred is fundamental to our understanding of early population movements. Large climatic shifts would have had a profound effect on early human groups moving across the landscape, allowing populations to exploit a wide range of resources during more humid times, and presenting a considerable barrier to population movements during arid phases. These issues lie at the heart of my research, and are a key component of the Palaeodeserts Project at the University of Oxford. Led by Professor Michael Petraglia, and with the support of the European Research Council (ERC), the Saudi Commission for Tourism and Antiquities (SCTA), and HRH Prince Sultan Bin Salman, our five-year project has recently uncovered intriguing new insights into how the 'greening' of Arabia played a critical role in the development of our species.

Over long timescales, green periods in Arabia are predominantly tied to fluctuations in the position of the African and Indian Ocean Monsoon rainfall belts. For many years it was thought that major humid episodes in Arabia were driven by global ice volume changes and glacial cycles. As the great ice sheets contracted every ~100,000 years, the monsoon belts intensified and shifted much further north, bringing with them large volumes of summer rainfall to much of the Arabian Peninsula and transforming the landscape. Conversely, during global glacial periods the monsoon rains were pushed further south and Arabia returned to the dry conditions we see today. This would mean that for most of human history the climate of Arabia was unable to support our ancestral populations.

Some of our recent findings, however, are providing a serious challenge to this notion. Evidence from ancient lakes and rivers, buried beneath the sands of the Rub' al-Khali and Nefud deserts, has shown that humid episodes may have occurred as frequently as every ~23,000, in line with periods of maximum solar radiation (Parton et al., 2015a; 2015b).

Figure 1: Photo of the Mundafan basin in the Rub' al-Khali, southern Saudi Arabia. This large depression was once home to a large freshwater lake.

As such, we now believe that there have been many more potential 'windows' for the expansion of human populations into and across Arabia than previously thought – a notion supported by the large number of archaeological sites scattered across the peninsula (Groucutt et al., 2015).

In the Rub' al-Khali desert to the east of Najran in southern Saudi Arabia, the Palaeodeserts Projects has unearthed a series of buried artefacts situated along the edge of an ancient lake basin. Today the landscape is extremely arid, with no water or vegetation for many miles around (see Figure 1), however, our findings show that the basin was once home to a large freshwater lake fringed by grasslands and palms. Here, it seems, a group of early hunter gatherers took advantage of the lush environment, leaving behind a number of stone tools that eventually became embedded within the lakeshore, and leaving behind them tantalising clues as to the movements of early populations out of Africa. Further to the north, recent findings from the Nefud in northern Saudi Arabia near the towns of Tayma and Ha'il, have also yielded a wealth of archaeological, environmental and animal material that demonstrate how dramatically the climate of Arabia has changed, and how important these changes were to human and animal populations.In the spring of 2013 we uncovered ancient lake deposits from an oasis town called Jubbah (Figure 2). These sediments have provided an incredibly detailed record of rainfall and vegetation changes for the region and will provide a critical framework for the regional archaeological record. Jubbah, it

Figure 2: Photo showing the logging and sampling of a large ancient lake sequence near the oasis town of Jubbah, Saudi Arabia.

seems, has been an important focus for human populations - most likely due to the presence of a large lake - with evidence for occupation of the oasis stretching back over 200,000 years. To the west near the town of Tayma, some of our most impressive discoveries were made in the autumn of 2013. Here, we discovered a wealth of animal remains, again situated adjacent to an ancient lake (Figure 3), including oryx, fox, grebe, jaguar and perhaps most impressively, elephant. These are surrounded by numerous smaller lake deposits, upon which stone tools possibly reaching as far back as 500,000 years have been deposited.

Such findings are testament to both the variability of the Arabian climate, and the fundamental role such changes have played in the trajectory of early human populations.

Figure 3: Excavating fossil remains embedded into the surface of an ancient lake deposit in the Nefud Desert near Tayma, northern Saudi Arabia.

Increases in rainfall every ~23,000 years led to increased freshwater availability and the expansion of vegetation. This allowed animal and human populations to expand their seasonal range beyond Africa and the Levant, and exploit new pastures deep into the Arabian interior. It's likely that as they expanded, these groups had to adapt to their new environment and in so doing, developed new technological capabilities that allowed them to successfully disperse across the world. Yet, while it seems that all regions of Arabia experienced dramatic climate shifts over the past few hundred thousand years, it is unlikely that such changes were uniform across the entire peninsula. As such, issues concerning the spatial and temporal variability of the Arabian climate continue to be the main focus of my research, and that of the Palaeodeserts Project. The incredible findings from our sites have demonstrated that hidden beneath the vast sand seas of Arabia lies evidence for a complex and dynamic climatic history; one that undoubtedly shaped the fortunes of our earliest ancestors. While we endeavour to uncover more of these secrets, we are literally still just scratching the surface of Arabia's rich history, and we hope that we can continue to give the region the recognition it deserves as a place that has been central to the development of our species.

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Some of the findings of the Palaeodeserts team have been recently published in the journals Geology, Quaternary International and the Journal of Human Evolution. Ash's work has also recently been reported by media outlets such as the BBC, Science Daily and the Daily Mail. For more information about the project, visit the Palaeodeserts website or follow them on Facebook. You can also follow Dr Ash Parton's latest updates about his research on Twitter.

'At present, Ash is the palaeoenvironmental specialist for the Palaeodeserts Project from the School of Archaeology at the University of Oxford. His role within the project, and the overall aim of his research, is to understand the spatial and temporal variability of the Arabian climate over the past few hundred thousand years, by reconstructing environmental changes from ancient lake, river, soil and sand dune deposits. By developing a detailed record of climate changes for the region, Ash hopes to improve our knowledge of the long-term drivers of climate changes in Arabia, and how these changes may have impacted upon early human populations.'