Palaeoenvironmental Studies: a multi-proxy reconstruction of the sedimentological history of Jordan and adjacent areas (~20 000 BCE - present day)

Claire Rambeau, Palaeoenvironmental sub-project

Water supply is a key resource for any living being, and the proximity of water sources has most probably played a major role in the development of early human settlement. Variations in water availability are strongly dependant on climatic conditions, which underwent significant changes throughout the Quaternary period. A general change towards drier conditions, in semi-arid environments, can cause springs and streams to periodically or definitively dry up, ultimately forcing population to abandon permanent settlements and often to adopt a nomadic way of life. Wetter conditions may have enhanced the development of farming communities and enabled social and economic development. At the present day, water supply and management are still of the highest importance in the Middle East, being at the centre of economic, political and health concerns.

The Levant, and more particularly the Jordan Valley, represents an ideal context for studying the impact of late Quaternary climate change, and its impact on past human settlements. The Levant is divided between arid (S, E) and semi-arid (N, W) environmental conditions. The boundary of this divide has moved throughout the past, and the succession of different climatic conditions is likely to be registered in sediments deposited along the Jordan Valley and in adjacent areas during Quaternary times. Therefore, a detailed study of such sediments, using appropriate methods, will allow the reconstruction of past variations in environmental conditions.

A geological team composed of myself, Prof. Bruce Sellwood, Dr. Stuart Black, and Rachel Goodship - an undergraduate student - undertook a trip to Jordan in July 2006, in order to select areas of specific interest and realize preliminary sampling. Three locations were given a particular consideration: Beidha, Wadi Faynan and the Dead Sea eastern shore. These localities all have well-developed travertine series, which are the consequence of intermittent activity by springs. In the context of this project, they represent a particularly interesting material since travertines are composed of laminated carbonates, each laminate corresponding to a short period of deposition; these carbonates have therefore the potential to give information on fluctuating climatic conditions, with a time resolution that may be down to a year. Stable isotope composition from the laminates will help to reconstruct variations in environmental conditions, such as the identification of drier and wetter periods.

At Beidha, near Petra, carbonate nodules inside paleosols, as well as travertine deposits, were sampled in the vicinity of Natufian and Neolithic human settlements.

Figure 1: Part of the travertine sequences outcropping along the Dead Sea eastern shore.

Photo: Bruce Sellwood; Claire Rambeau for scale.

The archaeological site of Wadi Faynan, with its fluvitail sequences and well-developed travertine sequences, will be the framework of detailed sampling in October 2006. The Dead Sea shore area was more intensively examined, due to the huge amount of travertine carbonates observed in this location. A selection of samples were collected from major groups of travertine deposits, which probably cover most of the Late Quaternary period. Another interest of the Dead Sea shore area lays in the presence of highly-laminated, extensive series of lacustrine carbonates related to the former Lake Lisan, which cover the time period comprised between ~ 70,000 and 15,000 BP. Detailed stratigraphic descriptions have been realized for several little sections within this formation; corresponding samples will be analysed by Rachel Goodship as a research project for her degree.

The travertine deposits and other carbonate samples, with the exception of the Lake Lisan sequences, will be analysed during the forthcoming year. The carbonates are currently being dated prior to further analysis. When possible, additional dating will be obtained, for example by analysing charcoal remains and gastropod shells included into the limestone sequences. A high-resolution sampling will then be scheduled for each travertine group covering periods of time which present the best interest for the project's area of research.

Information obtained from these carbonates will be integrated with a review of already available data (sedimentological and botanical studies, marine records, lake levels, paleosols evidences...). This review will enable us to prepare palaeo-climatic maps of the Levant area, including those for estimated rainfall, for selected time periods and play a major role in refining the palaeo-climatic models being developed by the WLC meteorologists.

Water and food resources use in Jordan by stable isotope analysis of human and faunal skeletal remains

Michela Sandias, Archaeology sub-project

The study of water and food consumption by stable isotope analyses of human and faunal remains is a key element of the WLC Project. This study will analyse material from archaeological sites from areas of Jordan, selected to differ in their geographical and environmental characteristics. The carbon, nitrogen and oxygen isotopic compositions of skeletal remains from those sites will interpreted in relation to the estimated availability and source of water and food resources, drawing on research being undertaken elsewhere within the WLC project.

A field visit in July 2006 in Jordan acquired a first series of human and faunal bone and tooth samples for analysis from assemblages curated in the Department of Anthropology, of Yarmouk University, Irbid. This followed a two-week trip in April 2006, during which I was able to meet various Jordanian archaeologists and assess which skeletal assemblages were available and of potential interest for my study.

The ideal material for performing stable isotope analysis for palaeodiet and environmental reconstruction is well-contextualized and dated skeletal remains. Ideally, data relating to sex, age-at-death and health should be available. Archaeologists and anthropologists at Yarmouk University have already excavated and studied skeletal remains from numerous Jordanian archaeological sites. They have shown great interest in the istotope project and made some of those skeletal collections available for us to study.

My current focus is on skeletal remains from the archaeological site of Tell Ya'mun. This site is located in northern Jordan approximately 25 Km from the city of Irbid, at an altitude of 828m. Excavations started in 1999 and have revealed a continuous occupation of this site from the Early Bronze Age to the Byzantine period. This prolonged occupation represents one of the most interesting features of this site along with its geographical position. Its skeletal remains were recovered from the numerous tombs, the chronology of which has been based on pottery, grave goods, and tomb architecture.

The first days at Yarmouk University in July 2006 were used to examine the excavation