Right femur of a typical 8.5 year old (left) and right femur of an 8.5 year old with delayed growth (right).
Introduction

Analysis and reexamination of the skeletal material recovered during all six excavation seasons of the Amarna South Tombs Cemetery project was conducted from 18 May to 11 June 2011. The project participants were Professors Jerry Rose and Bill Schwab, Dr. Dolores Burke and Mr. Robert Taylor Montgomery from the University of Arkansas, Fayetteville; Dr. Melissa Zabecki from the University of Arkansas, Fort Smith; and Dr. Gretchen Dabbs from Southern Illinois University. There had been no new excavations in the South Tombs Cemetery since the last study season on the human remains. Almost all of the skeletal material from past seasons, consisting of 165 crates and 9 small boxes, were removed from the on-site storage magazine and examined in the Amarna house labs for the month.

The goals of this season were determined by the results of last year’s analysis of the data collected during the previous five years of excavation and skeletal data collection. The unusual demographic profile characterized by an excessive number of juvenile deaths continues to be a focal point for understanding the Amarna population and compelled us to apply new complex age and sex determination techniques to both children and adults. Professor Tony Legge’s research and publication (2010) of the animal bones studied during the 2009 and 2010 seasons suggested that pigs were punished by stab wounds to the shoulder. In previous research seasons, similar injuries have been observed on the scapulae of the Amarna human skeletons and we wanted to look more closely at these individuals. Analysis of the measurements taken of the skulls during the 2009 season indicated great population diversity at Amarna. This prompted the measurement of the skulls excavated during the 2010 season using new complex equipment. Finally, the large number of individuals from the South Tombs Cemetery and the large quantity of different kinds of data being collected (see previous osteological reports) required that a computerized database be developed and all of the Amarna skeletal data be entered to facilitate further analysis. Analysis of the data will continue throughout the coming year, while our preliminary results are presented here. All team members contributed to the collection of data in the laboratory, analysis of data, and preparing some of the text presented in this report of the 2011 season. We thank our Ministry of Antiquities Affairs Inspector Mr. Helmi Hussein Soliman for facilitating our access to the skeletal collections.

Methods

Beginning with the children, each skeleton was arranged on a laboratory table in anatomical position from head to feet. The information found on the nine page skeletal data forms that had been filled out during each of the previous years (2005–2010) was checked for consistency and recording errors. When errors were found, the new information was written on the form and highlighted so that corrections could be made on the master set of the forms kept at the University of Arkansas. In 2010 a new and greatly improved system for determining the age of children was published (AlQahtani et al. 2010) and we began to use this system during the 2010 season. This year all the children excavated with teeth between 2005 and 2009 were re-assessed for age using the AlQahtani system.

The analysis of growth rates conducted in 2010 showed that both long bone growth and development at Amarna were delayed by two or more years when compared to published growth standards (e.g., Maresh 1970), thus a system designed specifically for Amarna had to be developed to determine the age of children when the skulls or teeth were not recovered during excavation (cover image).

Accurate adult age is very important for interpreting the complex demography of Amarna and we were compelled to go beyond the routinely used system of age determination (e.g., Buikstra and Ubelaker 1994) to employ the complex system of transition analysis that required us to rescore all of the adult pubic symphyses, auricular surfaces of the pelvis, and cranial sutures (Boldsen et al. 2002). Sex was estimated for some skeletons who lacked pelvic bones using the multivariate statistical formula developed for Amarna scapulae (Dabbs 2010).
Last year five adults were found with evidence of being stabbed in the shoulder blade (scapula) (Figure 1). All adult scapulae were carefully examined this year for additional cases using the criteria established for pig scapula by Tony Legge (2010) as a guide.

An 'Access' (Microsoft Office) database used for entering data following the 'Standards' protocol (Buikstra and Ubelaker 1994) was extensively modified for use at Amarna. As each set of Amarna data forms were corrected by comparison with the skeletons, the data were entered into the database.

**Results and discussions**

The ages at death of 58 children were determined using the AlQahtani et al. (2010) system. This reexamination resulted in 50% of the ages being changed slightly between one and two years on average. The means and ranges of all long bone lengths of these dentally aged children were tabulated for each AlQahtani dental development age group. The children without teeth were then assigned to an age group based on the size of their postcranial bones. Twenty-one children without teeth were aged using this system and their ages were revised downward by an average of 20 months (Figure 2). Eight children without teeth or long bones remain unaged. This system is now available to be used for all future children excavated at Amarna who lack sufficient teeth for age determination. It is necessary to use this newly devised long bone length system because growth and development of the Amarna children is 18 to 26 months behind dental development. Publication of these results is planned.

Each pubic symphysis and auricular surface of the pelvis was scored by recording each age component separately to enable us to conduct computerized transition analysis. These data were recorded for 149 adults and is expected
to produce a more realistic distribution of adult ages at death and allow mortality to be modelled more accurately, with adults ages modified by five to ten years from previous assessments.

Sex determination using the newly devised discriminant function technique for the scapula (Dabbs 2010) enabled us to make sex assignments for 21 individuals who previously could not be assessed.

Measurements of 23 skulls excavated in 2010 were obtained for inclusion in the sample and analysis of population variation at Amarna. A new instrument for measuring mandibles was purchased and brought to the site by Dabbs. This mandibulometer produces more precise measures of the mandible. Forty-eight mandibles were measured with this new tool.

All adult scapulae were examined for possible puncture wounds. Four of the five wounded scapulae identified in the 2010 analysis were confirmed using the pig criteria provided by Legge (2010). One new punctured scapula was identified. Thus, Individuals 39, 56, 102, 142, and 191 show evidence of healed wounds of the scapula. All of these people are adult males and most of them had significant trauma besides the scapula wounds. Because these are all well healed wounds and no other trauma to the ribs or skeleton has been found in association, we suggest that this is possibly one form of punishment carried out to cause pain without permanently disabling the individual.

Data from 254 records of both children and adults have been entered into the newly designed Access skeletal database.
Conclusions

Although no new skeletal material was available for study this year, we gained a lot of new and useful information that will enable us to more accurately analyze the Amarna skeletons in future seasons. We have significantly fine-tuned the demography using new and updated methods, we have had a chance to look at some peculiar pathology as a whole instead of looking at different individuals in different years, and we now have a database for scientists and students to have access to our information for comparative purposes.

Bibliography


