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Counting Chins to Count People: Determining MNI for Umm an-Nar Tombs from Mandibular Fragments

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Counting Chins to Count People: Determining MNI for Umm an-Nar Tombs from Mandibular Fragments

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Hypotheses

- As tomb Unar 2 is larger in diameter (14.5 m) and has more chambers (n=12) than tomb Unar 1 (diameter = 11.5 m, 8 chambers) (Blau, 1998), we expected a larger MNI (minimum number of individuals) in Unar 2 as a reflection of these spatial differences.
- Conversely, as Unar 2 was closer temporally to the "cultural collapse" of Umm an-Nar culture around 2000 BCE, it is expected that Unar 2 will have a lower MNI than Unar 1 – which was in use during a period of relatively greater cultural stability (Gregoricka, 2016).
- Zonation (Knüsel and Outram, 2004) and landmark (Mack et al., 2016) methods will yield a similar MNI, as the latter is a modified version of the former, and both methods were found to provide more conservative results for fragmented material than the traditional MNI method in a comparative study (Lambacher et al., 2016).

Background

The Umm an-Nar period (2700-2000 BCE) was a time of rapid transformation in the Oman Peninsula, marked by changes in mortuary practices and the appearance of settlements, local ceramics, and oasis agriculture (Potts, 2000). The tombs of this period varied greatly in size, as did the number of people interred within them. The human remains within these collective tombs became commingled as previous interments were moved aside to make room for the newly dead and included a mixture of cremated and non-cremated remains (Figure 1). Umm an-Nar tombs also appear to have included all individuals in the community, reflecting the importance of social cohesion along with a collective memory for the people of the time (Magee, 2014).

Figure 1: **Mandibular condyles with varying degrees of cremation from tomb Unar 2.**

Figure 2: **Foundations of Umm an-Nar tomb Unar 2, after excavation.**

Multiple techniques exist to calculate MNI. The two methods utilized here were the zonation method (Knüsel and Outram, 2004) and the landmark method (Mack et al., 2016). MLNI (minimum likely number of individuals) methods were not used, as these rely on conjoining exercises to avoid double counting, which was not possible for this project due to the highly fragmented nature of the skeletal collection (Kendell and Willey 2014).

Materials & Methods

Over 1500 mandibular fragments were examined from tombs Unar 1 (2400-2200 BCE) and Unar 2 (2300-2100 BCE) (Figure 2), located at the site of Shimal in the Emirate of Ras al-Khaimah in the United Arab Emirates. Fourteen zones were used to calculate MNI adapted from the seven zones outlined in Knüsel and Outram (2004) as part of the zonation method (Figure 3). Similarly, 14 landmarks (Figure 4) were selected from White et al. (2012) to calculate MNI using the landmark method (Mack et al., 2016).

Zones and landmarks were scored if >50% of the relevant portion was present (Figure 5). Due to the fragmentary and commingled nature of these collections, many fragments were scored "IND," or indeterminate. If a fragment could not be sided, it was designated as IND and was not scored for zones or landmarks.

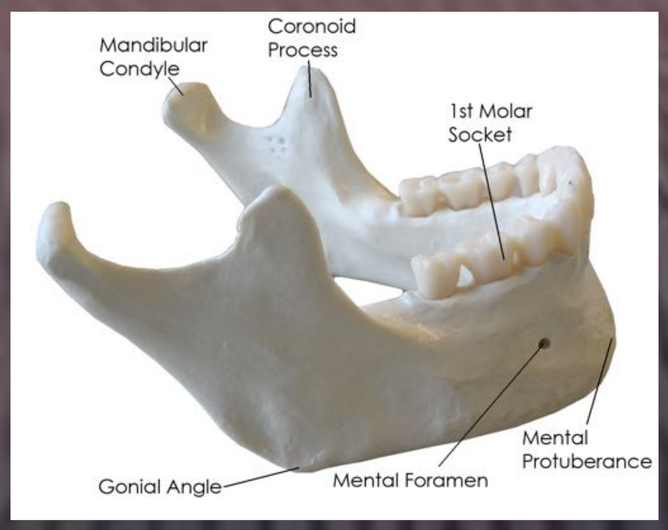

Figure 4: **Diagram of Landmarks used in this study (not pictured: mental spines, mandibular foramen)**

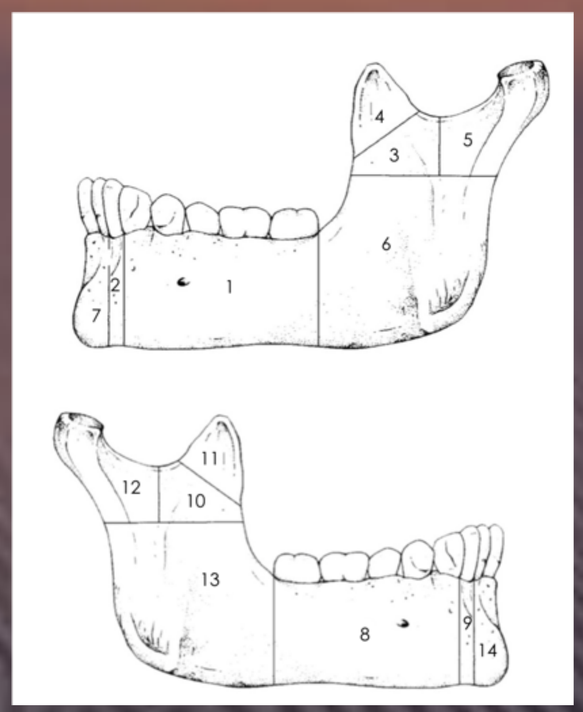

Figure 3: **Diagram of zones 1-14 (Top=Left, Bottom=Right) (adapted from Knüsel and Outram 2004)**

Figure 5: **Co-first authors QB (left) and CA (right) sorting mandibular fragments by size and type.**

Results

MNI of the two tombs:

- Landmark method (Figure 6): Unar 1: n=101 Unar 2: n=290
- Zonation method (Figure 7): Unar 1: n=86 Unar 2: n=263

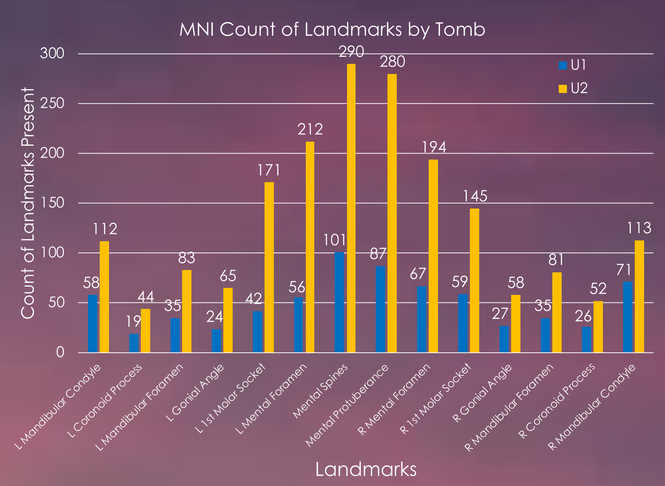

Figure 6: **MNI at Unar 1 and Unar 2 using the landmark method. Landmarks are in anatomical order, left to right.**

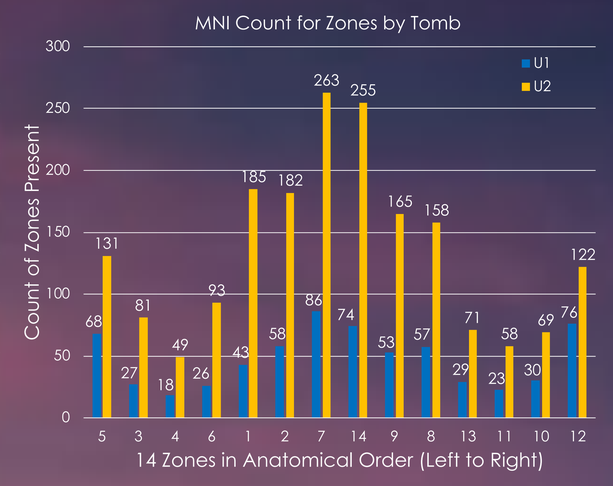

Figure 7: **MNI at Unar 1 and Unar 2 using the zonation method, displayed with the zones in anatomical order.**

The landmark method consistently produced higher MNI counts than the zonation method. However, when the final MNI counts for Unar 1 and Unar 2 for both methods were compared statistically utilizing a Chi-square test, there was no statistically significant difference between them (χ^2=0.08, df=1, p=0.78). There was, however, a significant difference between MNIs generated for each landmark when values were compared between the tombs (χ^2=34.41, df=13, p<0.001), as well as for each zone (χ^2=34.54, df=13, p<0.001).

Unar 1 and 2 were also compared to other Umm an-Nar tombs in the UAE on the basis of MNI values and tomb diameter. A Spearman's Rank-Order Correlation test found no association between MNI and tomb diameter (r= 0.048, p=0.91, n=8) (Figure 8).

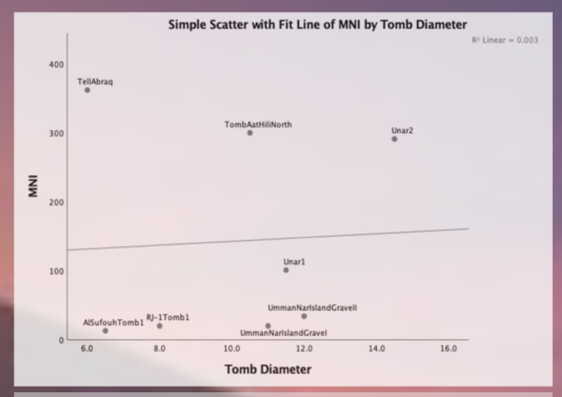

Figure 8: **Simple scatter plot with a line of fit (r^2=0.003) comparing tombs Unar 1 and Unar 2 to other Umm an-Nar tombs in the United Arab Emirates.**

Discussion & Conclusions

Studying MNI and implementing new methods of calculating it are important in the field of bioarchaeology. We hoped to provide insight into what methods would prove most useful for calculating MNI in commingled, fragmentary collections, as well as how that number should be interpreted and used.

We argue that the most appropriate method to calculate MNI is dependent on the collection being studied as well as the element under consideration. The skeletal collections from tombs Unar 1 and 2 feature highly fragmented human remains (Figures 1 & 9) with very few instances of articulation. For fragmented collections such as these, the zonation method is not ideal (or should be modified depending on the needs of the researcher). Here, the zonation method yielded a lower MNI when using the mandible, possibly because the mandible was often fragmented into small pieces. This made establishing a >50% presence of a zone unlikely when considering Zones 1(left)/8(right) and 6(left)/13(right) – which are relatively large areas on the mandible. Further, some zones were challenging to identify regardless of size, such as Zones 3(left)/10(right); these were usually identified in conjunction with another zone rather than on their own.

Figure 9: **Mandibular fragment with erupting teeth from Unar 2. This specimen is typical of fragmentation across both tombs.**

Conversely, the landmark method was both practical for the collection and highly effective. The mandible contains many easily identifiable landmarks interspersed fairly evenly throughout the bone. At Shimal, the medial posterior portion of the mandible that contained the mental spines was most well preserved (Figures 6 and 7).

Both tombs were in use for roughly the same amount of time but have very different MNI values - the MNI of Unar 2 was three times larger than the MNI of Unar 1. This may suggest that through time, more individuals within the community were permitted access to the large Unar 2 tomb. Therefore, an even larger group of people had their individual identities obscured, supporting the notion of social cohesion within the Shimal community prior to the so-called "cultural collapse" of the Umm an-Nar period.

Comparative analyses revealed no significant relationship between tomb diameter and MNI values across southeastern Arabia (Figure 8), with some smaller tombs containing the largest number of individuals (e.g., Tell Abraq). This suggests that tomb size was not simply a function of the number of people interred for communities of the Umm an-Nar period. Further research into this area and assessment of MNI from nearby tombs is warranted to further elucidate this issue.

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