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Investigating dietary patterns and human mobility in bone apatite at the Zhuangqiaofen site (5000-3700 BP), Zhejiang Province, China

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1 **Investigating dietary patterns and human mobility in bone apatite at the**  
2 **Zhuangqiaofen site (5000-3700 BP), Zhejiang Province, China**

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15  
16 **Abstract**

17 The Taihu Lake basin is one of the cradles of Chinese civilization with abundant  
18 archaeological sites, but the humid and acidic soil conditions of this part of China limit  
19 the application of studies using stable isotope ratios of bone collagen. To circumvent  
20 this problem, we explore the suitability of using bone hydroxyapatite for stable isotope  
21 ratio measurements of carbon ( $\delta^{13}\text{C}$ ) and oxygen ( $\delta^{18}\text{O}$ ) as a substitute to collagen in  
22 order to obtain dietary and mobility information about humans (n=22) and animals  
23 (n=7) from the Neolithic site of Zhuangqiaofen. The human  $\delta^{13}\text{C}$  values range from  
24  $-14.0\text{‰}$  to  $-11.5\text{‰}$  and have an average of  $-12.8 \pm 0.7\text{‰}$  which indicates that they  
25 were mainly consuming a C<sub>3</sub> diet, most likely rice (*Oryza sativa*). The range of  $\delta^{13}\text{C}$   
26 values of the dogs ( $-13.6\text{‰}$  to  $-12.5\text{‰}$ ; n=5) and pigs ( $-13.9\text{‰}$  and  $-12.7\text{‰}$ ; n=2) are  
27 similar to the humans and also suggest that they consumed C<sub>3</sub> foods. Humans have a  
28 wide range of  $\delta^{18}\text{O}$  values ( $-12.7\text{‰}$  to  $-8.5\text{‰}$ ) with an average value of  $-10.8 \pm 1.2\text{‰}$ ,  
29 which suggests that they were mobile and ingested water from a variety of different  
30 sources. This human mobility might be attributed to: the need for labor to construct  
31 public works at larger sites in the area, trade networks involving jade and pottery in the  
32 Jianghuai region or to the unique funerary customs of the Liangzhu Culture that were  
33 based on blood relationships. In contrast, the dog  $\delta^{18}\text{O}$  values have a much smaller  
34 range ( $-12.0\text{‰}$  to  $-11.4\text{‰}$ ) and have an average value of  $-11.7 \pm 0.2\text{‰}$ . The  $\delta^{18}\text{O}$   
35 values of the two pigs are nearly identical at  $-12.1\text{‰}$  and  $-12.2\text{‰}$  and similar to the  
36 dogs, and these results can be used as an isotopic baseline with which to compare the  
37 human  $\delta^{18}\text{O}$  results.

38  
39 **Keywords:** bone apatite; stable isotopes; diet; mobility

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