EXPLORING EARLY FARMING DIETS AND POPULATION DYNAMICS IN THE NEOLITHIC CENTRAL BALKANS

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Research background

The adoption of agriculture and sedentary lifestyle in the Neolithic may have triggered the process of Neolithic Demographic Transition (NDT) which, eventually, promoted the formation of early urban centres (e.g. Bocquet-Appel 2002; Belwood, Oxenham 2008; Drennan, Peterson 2008). The change in the food procurement system (from foraging to food production) and diet (e.g. greater intake of carbohydrates) is seen as a key factor in the increase of fertility rate leading to the remarkable population growth. No direct evidence, however, such as osteological or nutritional indicators has been examined to establish the absolute link between the 'cause' (dietary shift) and the 'effect' (population growth) offered as an explanation for the NDT.

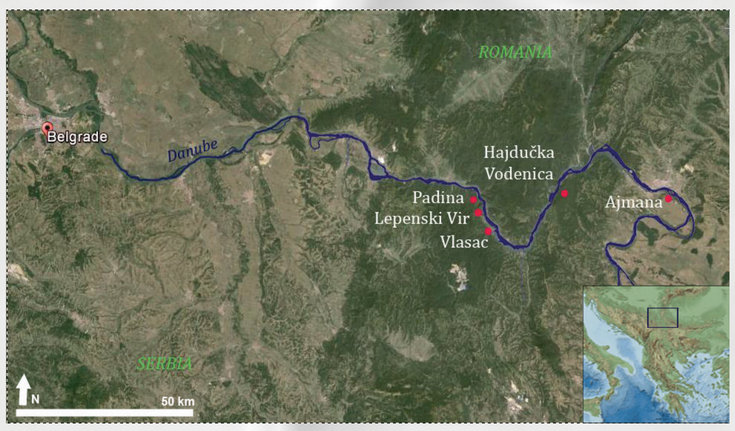

Fig. 1 Selected sites in the Danube Gorges area

The present study: aims, methods and first results

Testing the hypothesis of increased female fertility at the start of the Neolithic, and exploring the relationship between fertility rates and the introduction of 'new foods'/agriculture are the main goals of the recently initiated project 'Births, mothers and babies: prehistoric fertility in the Balkans between 10000-5000 BC' (*BIRTH*). The project combines physical anthropological approach with the study of palaeonutrition. It examines skeletal indicators of pregnancies, length of the reproductive period, birth-related changes in female body, neonate body proportions and survival period, and health status of infants and adults. The role of diet in the population dynamics is explored through the analysis of macro- and micro-nutritional contribution of food to the overall reproductive status and health, and the potential role of plant food in weaning.

The study generally focuses on the Danube Gorges area in SE Europe that yielded a large number of human skeletal remains. This region was more-or-less continuously occupied from the Final Upper Palaeolithic (*c.* 13000 BC) to the Early Neolithic (*c.* 5900-5500 BC), including the Transformational (Mesolithic - Neolithic) phase (*c.* 6300-5950 BC) (Borić 2011).

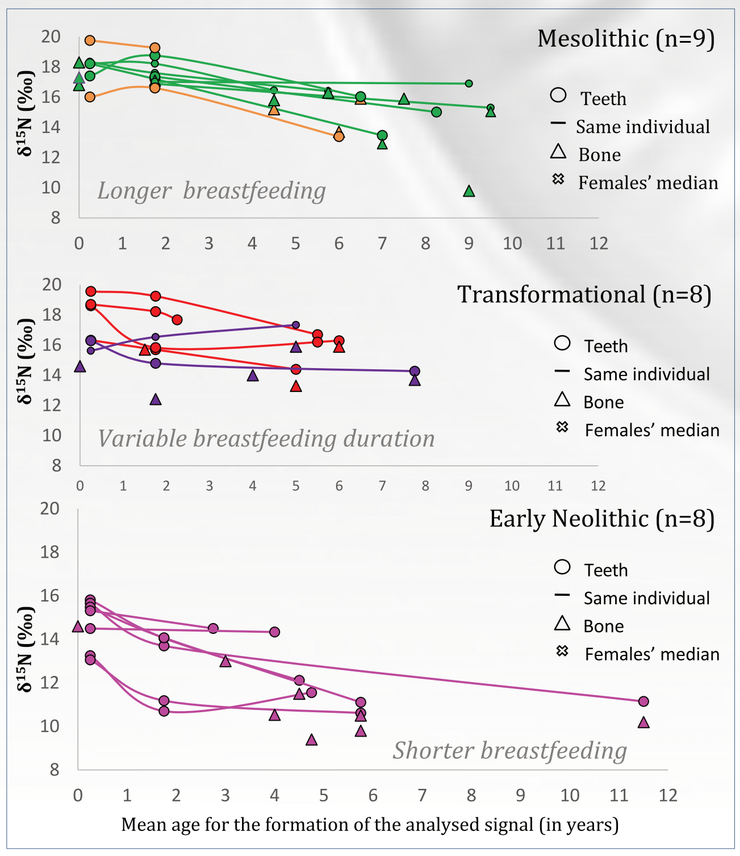

Fig. 2 *Breastfeeding duration based on $\delta^{13}C$, $\delta^{15}N$ and $\delta^{34}S$ values for dentine from m1 and M1 crown and from developing teeth root and bone*

Previous anthropological and stable isotope analyses (carbon, nitrogen and sulfur) of infant bone and teeth from several of the sites in the Gorges indicated differences in the breastfeeding duration between the Mesolithic and the Transformational/Early Neolithic period (Fig. 2). They also revealed between-site variability – e. g., the isotope data for infants from the Early Neolithic site of Ajmana show low duration of breastfeeding compared to those for Early Neolithic infants found at the site of Lepenski Vir.

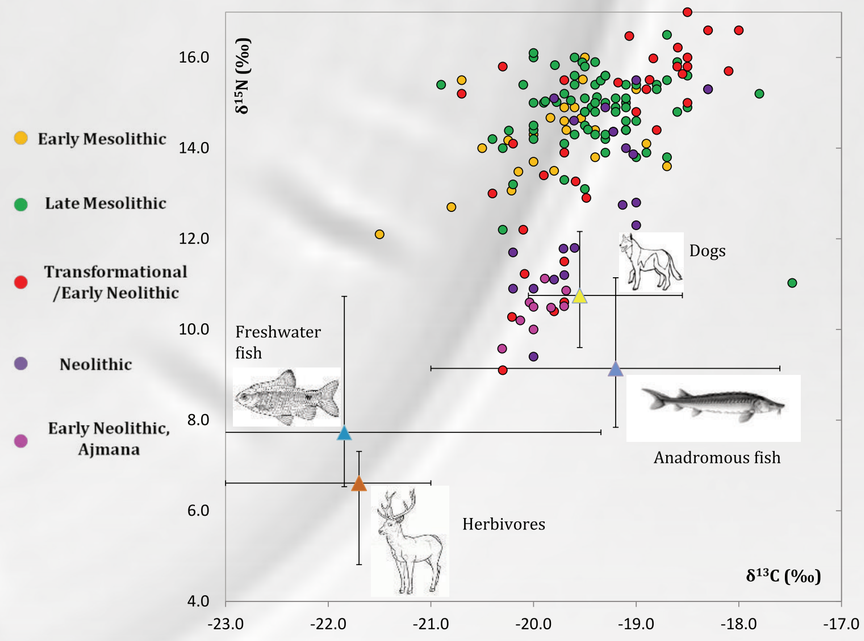

Fig. 3 *Collagen $\delta^{15}N$ and $\delta^{13}C$ values for Mesolithic and Neolithic adult humans and animals from the Danube Gorges (n=153 of which 43 unpublished; Bonsall* et al. *1997; Grupe* et al. *2003; Borić* et al. *2004; Nehlich* et al. *2010; Borić, Price 2013)*

Further, the isotope values show diachronic and intra-regional differences in the composition of the diet. At some sites, the generally fish-based Mesolithic diet remains apparently unchanged in the Early Neolithic, whereas at other sites (animal) food of terrestrial origin seems to become dominant in the Transformational/Early Neolithic period, perhaps due to greater reliance on meat from domestic animals (Fig. 3).

Very few charred seed/fruit remains have been found at Mesolithic and Early Neolithic sites in the Danube Gorges. Thus starch preserved in dental calculus and on artefacts potentially used in food preparation/consumption is explored as another possible evidence of plant consumption. Given the detected variation in breastfeeding duration and the assumed introduction of cereal-based weaning food, dental calculus preserved on infant teeth and residue from the surface of tools possibly used in infant feeding (Fig. 4) have been examined

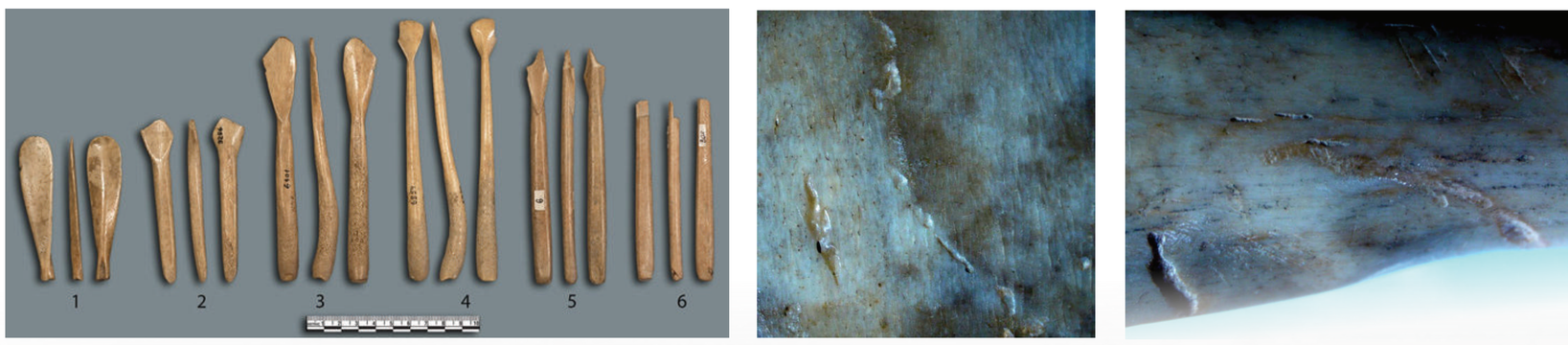

Fig. 4 *'Spoons/spatulas' potentially used in infant feeding, as indicated by the surface wear that includes possible bite marks and drag marks made by deciduous teeth*

Initial work revealed the presence of wheat starch grains in dental calculus removed from the jaw of an Early Neolithic infant (Fig. 5a-b) and in the residue on the surface of an Early Neolithic spoon/spatula (Fig. 6a-b). The identified starch grains could have derived from ancient food. However, contamination from ancient and modern sources is highly possible and the authenticity of the starches remains to be tested.

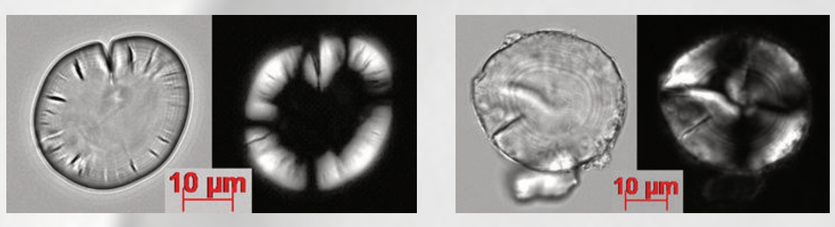

Fig. 5a-b *Starch grains found in calculus from the Early Neolithic infant jaw* *

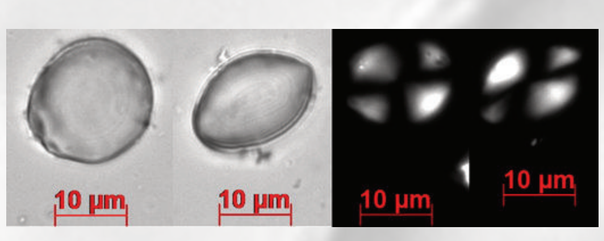

Fig. 6a-b *Starch grain found in residue sonicated-off the tip of a bone 'spoon'* *

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