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THE IMPORTANCE OF PORRIDGE

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The Neolithic is characterised by the introduction of permanent food resources - cultivated cereals and domesticated animals. There is also the appearance of fired pottery. It is a time when there was a notable increase in the population, but whether this increase was a cause or a consequence of the changes in food resources is still a matter for debate.

Changes in the nature of the food consumed can be revealed through a study of the microwear patterns developed on the occlusal surfaces of the teeth, as well as from the levels of trace elements and stable isotopes within the bones.

Excavation of the site of Abu Hureyra on the Euphrates river in northern Syria has provided a sequence of human remains extending throughout the Neolithic, a period of 3000 years (Moore 1975). In addition there are isolated fragments attributed to the Epipalaeolithic (Mesolithic) and a valuable series of human skeletons from the medieval (Modern) period.

The settlement was established on the southern banks of the Euphrates river sometime in the Epipalaeolithic, about 11,500 years ago. The site was excavated by Andrew Moore in 1972 and 1973 in advance of the building of the Tabqa dam. Seven trenches were excavated in different parts of the tell. An extensive series of radiocarbon dates undertaken by the Oxford Accelerator laboratory has established a precise framework for the dating of the main trenches B, D and E (Moore 1992).

All spoil was sieved, and plant remains were recovered by flotation to provide representative samples of animal and seed remains. The wide range (157 species) of wild seeds exploited during the Epipalaeolithic appears to have been supplemented by the introduction, in the early Neolithic, of domesticated cereals, including wheat, emmer wheat, barley, oats and rye. Gazelle meat was the most important source of animal protein in the early aceramic Neolithic (2A) as it had been in the Epipalaeolithic. The herds appear to have been culled on a seasonal basis, at the stage in their migration route when they approached the waters of the Euphrates river to calve (Legge and Rowley-Conwy 1987). In the later aceramic (2B) the bones of domesticated sheep and goat appear.

The extent to which changes in plant and animal remains recovered from different levels in the excavations reflect changes in diet of the inhabitants of Abu Hureyra can be followed through trace element analysis of the food remains and of the human skeletons. Although small samples only have been analyzed so far

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the different trophic levels of vegetarian gazelle and omnivorous humans are clearly revealed in the relative quantities of strontium, barium and chromium detected in the bones; whereas values for soil-borne elements like aluminium are not related to animal bone type (Fig.1). One reason for the lack of burial alteration could be that the burials, many of them secondary and de-fleshed, were interred into rooms of the houses and sheltered from rain water percolation; although there is evidence of ground water movement. (For a discussion of the diagenetic aspects of the site see Molleson, Williams and Vogel forthcoming). The trace element results suggest that there was actually an increase in the consumption of animal products in the later aceramic Neolithic (2B) with the introduction of domestic animals, but whether this was due to the greater availability of meat all year round or to the exploitation of milk products has still to be determined.

Examination of the human dentitions immediately revealed that the wear on the teeth was extremely severe (Fig.2). The teeth were worn flat, and in older individuals secondary dentine developed within the pulp cavities, implying the habitual mastication of hard food particles. Fractured teeth would result from biting on grit inclusions among the food particles, and lateral abscesses from inflammatory reaction to cereal glumes trapped between the gum and the tooth. Dental caries are very rare. This combination of dental characteristics suggests that a coarse dry particulate food was being eaten. Saddle querns and rubbers of igneous stone recovered from both Epipalaeolithic and Neolithic levels (Moore 1975), and the recognition of kneeling facets point to the preparation of flour from grains by grinding (Molleson 1989, 1994).

Scanning electron microscope (SEM) studies of the microwear on the occlusal surfaces of the chewing teeth reveal that there were dramatic changes in the nature of the food eaten during the Neolithic. When compared to microwear recorded on teeth derived from Epipalaeolithic levels there is a significant increase in pit size and density on teeth from aceramic Neolithic levels (Molleson and Jones 1991). This indicates that particles that were both harder and coarser than those of the Epipalaeolithic were being chewed by people of the aceramic Neolithic; and is consistent with the finding by Gordon Hillman (in Moore 1975) that domestic cereals appear in the plant assemblage only in aceramic Neolithic times. The wear on the teeth also indicates that the fragmented cereal grains were largely consumed in a dry state, as burghal or bread. This would have to be chewed to moisten it sufficiently before the bolus could be swallowed. It is interesting to note that the pit density on the teeth of a four year old child from aceramic 2B is less than that of adult counterparts from the same levels, although food particle size is apparently the same (Figure 3). It suggests that the child was being given the same food as were older individuals but that it was softened by soaking or pre-chewing as for a child that is being weaned.

The ceramic Neolithic (2C) at Abu Hureyra is identified by the appearance of a coarse pottery (Moore 1975). Although it is impossible to attribute anything more than an age category to the adults, the teeth seem to have been subject to a less abrasive diet, when compared to the dentitions of aceramic levels. Oral health also appears to deteriorate in 2C times with an increase in rates of dental caries and ante mortem loss that can be attributed to the consequences of dental caries rather than to apical infection through pulp exposure. Such an increase in dental

caries, although slight, could be a consequence of an increase in refined carbohydrates in the diet.

Microwear studies of the occlusal surfaces of molar teeth from ceramic (2C) levels at Abu Hureyra reveal that pit sizes are significantly smaller than anything recorded for teeth from aceramic levels. The pit sizes fall within the range of those recorded for modern populations both from Abu Hureyra itself and from 18th century London - populations that would have consumed cooked cereal flours. The flours would also have been sieved.

The effect of this new food technology seems to have been widespread. A four year old child from aceramic levels has only slight wear on its teeth, but in a seven year old from the same levels there is extensive wear, implying a transition from soft to a hard abrasive diet. In contrast the wear on the teeth of a ten year old child from 2C times is seen to be only slight - indicative of a much softer less abrasive food. It would seem that in 2C times the food is significantly softer than it had been in aceramic times (Molleson et al. 1993). The boiling of cereal flour produces a soft porridge or pap. Such a food is suitable to give to an infant, and thus to wean it, even before it has cut its first teeth.

The earlier weaning of an infant, given the presumed fat reserves of Neolithic women, would have relaxed the inhibitory effect of frequent lactation on ovulation, so that there would have been a tendency for the interval between conceptions to be reduced; the more so since boiled cereals are a convenient and easily digested food that would readily restore a woman's nutritional status and fertility.

An increase in fecundity, through reduction in the birth interval would account for the apparent change in the demographic structure of the population of Abu Hureyra in 2C levels that is indicated by the increase in the proportion of juveniles among the skeletons recovered from the excavated trenches. Although there is archaeological evidence that the population increased in size in later aceramic (2B) times there is none that there had been a change in the growth rate, the demographic structure remained as it had been in 2A times (Fig.4).

These interpretations can only be tentative suggestions given the very incomplete nature of the excavation of the tell and what we believe to have been highly selective burial practices. These limitations not withstanding there is the possibility that the introduction of pottery at Abu Hureyra 7300 years ago led to the development of a new method of preparing cereals by soaking and boiling. This pap or porridge was, and indeed still is, an excellent food whereby an infant can be weaned, even before it has cut its teeth. The consequence of that early weaning led to a reduction in the birth interval and so to the Neolithic population explosion: that is the importance of porridge.

CONCLUSIONS

The introduction of porridge was a contributory factor to the circumstances that resulted in the Neolithic population explosion.

In the pre-pottery (aceramic 2A, 2B) Neolithic at Abu Hureyra human teeth were subjected to coarse, hard particles requiring strong crushing action to render them soft enough to swallow. SEM photomicrographs show a frequency of large pits indicating that particles as hard as date stones were being processed.

Pottery was introduced at Abu Hureyra about 7300 years ago (5300 BC), and it is from this time, the ceramic (2C) Neolithic, that the microwear on the teeth can be identified as having been produced by cooked (boiled) food.

The demographic structure of the population also changes in the ceramic Neolithic. There are many more children, which implies an increase in the growth rate through increased fertility of the women. This would come about if the interval between births experienced by the mothers were reduced through earlier weaning of the infants. A boiled cereal, such as porridge, is a convenient food for weaning an infant; whereas before the advent of pottery it would probably have been necessary to pre-chew much of the food given to a weanling child.

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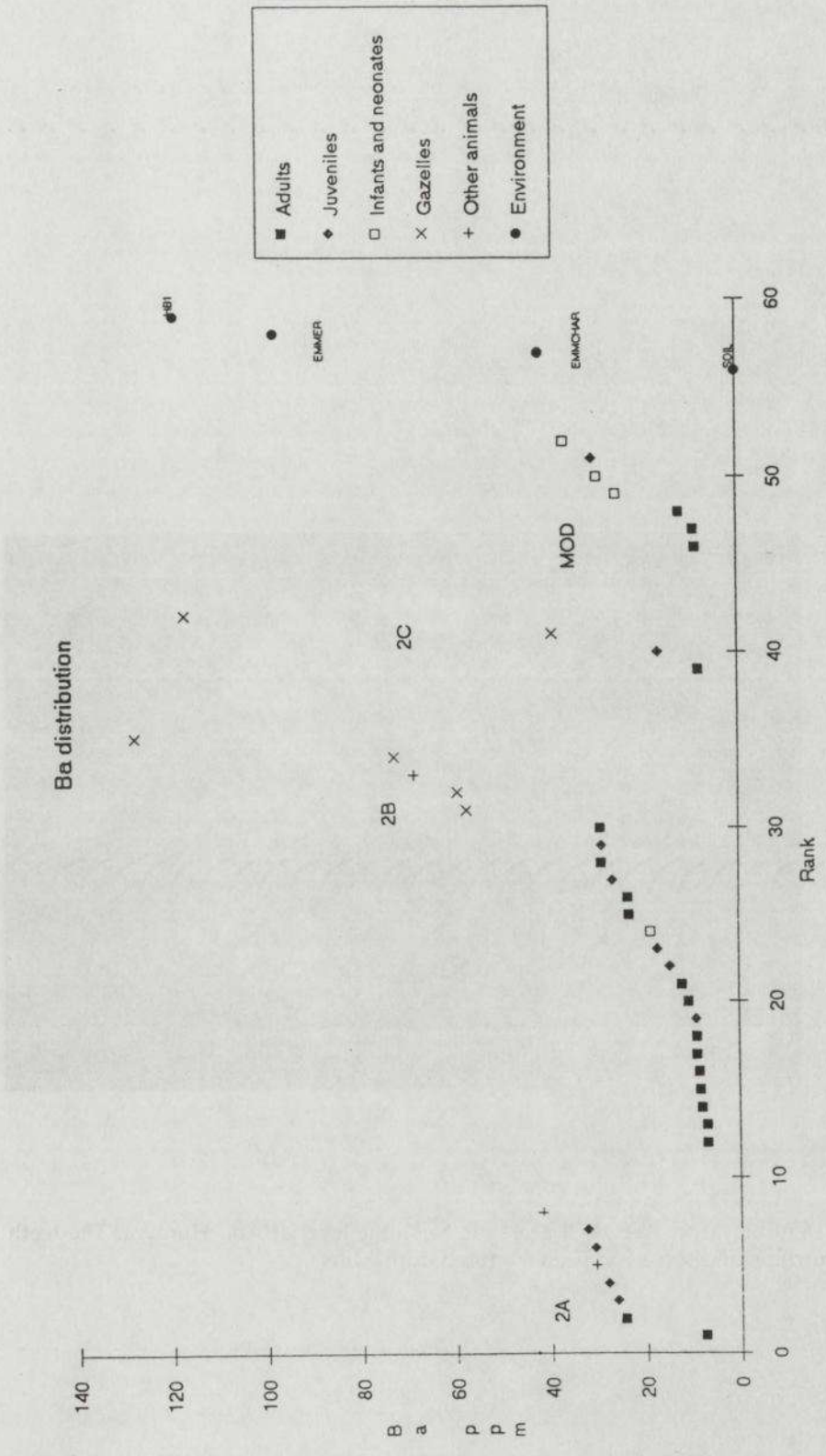

Fig. 1. : Concentrations of trace elements in human and animal bones from Neolithic and Medieval levels at Abu Hureyra are related to trophic levels. Barium (Ba) levels are higher in the bones of herbivorous animals (eg. Gazelle) than in the human bones. Levels are lowest in human bone from 2B aceramic Neolithic times; and Medieval (Mod) infants have relatively high levels, which may reflect early introduction of cereals into the diet. High barium was detected in the emmer wheat grain.

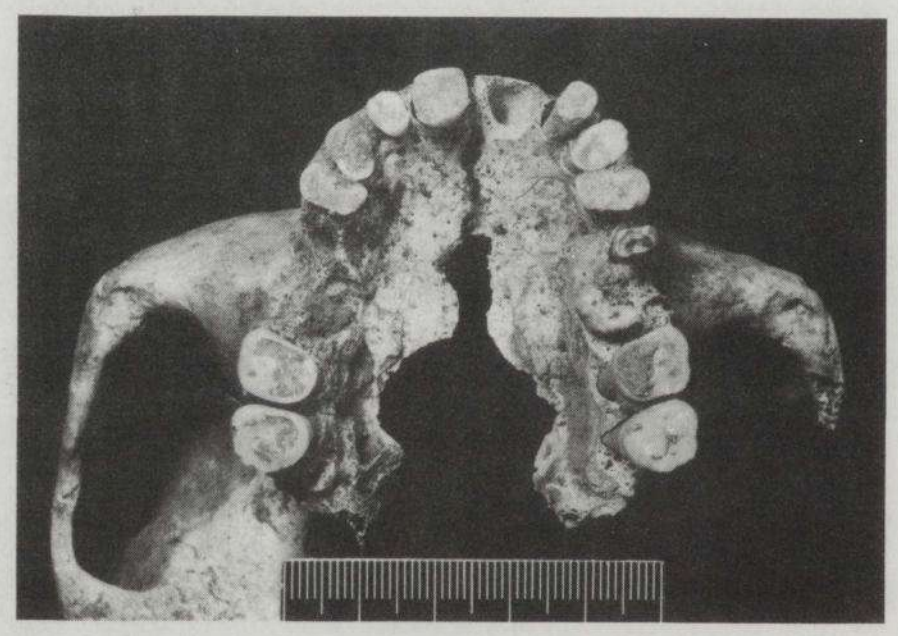

Fig. 2. : Dentition from Trench B aceramic Neolithic level at Abu Hureyra. The teeth show severe attrition and some had been fractured during life.

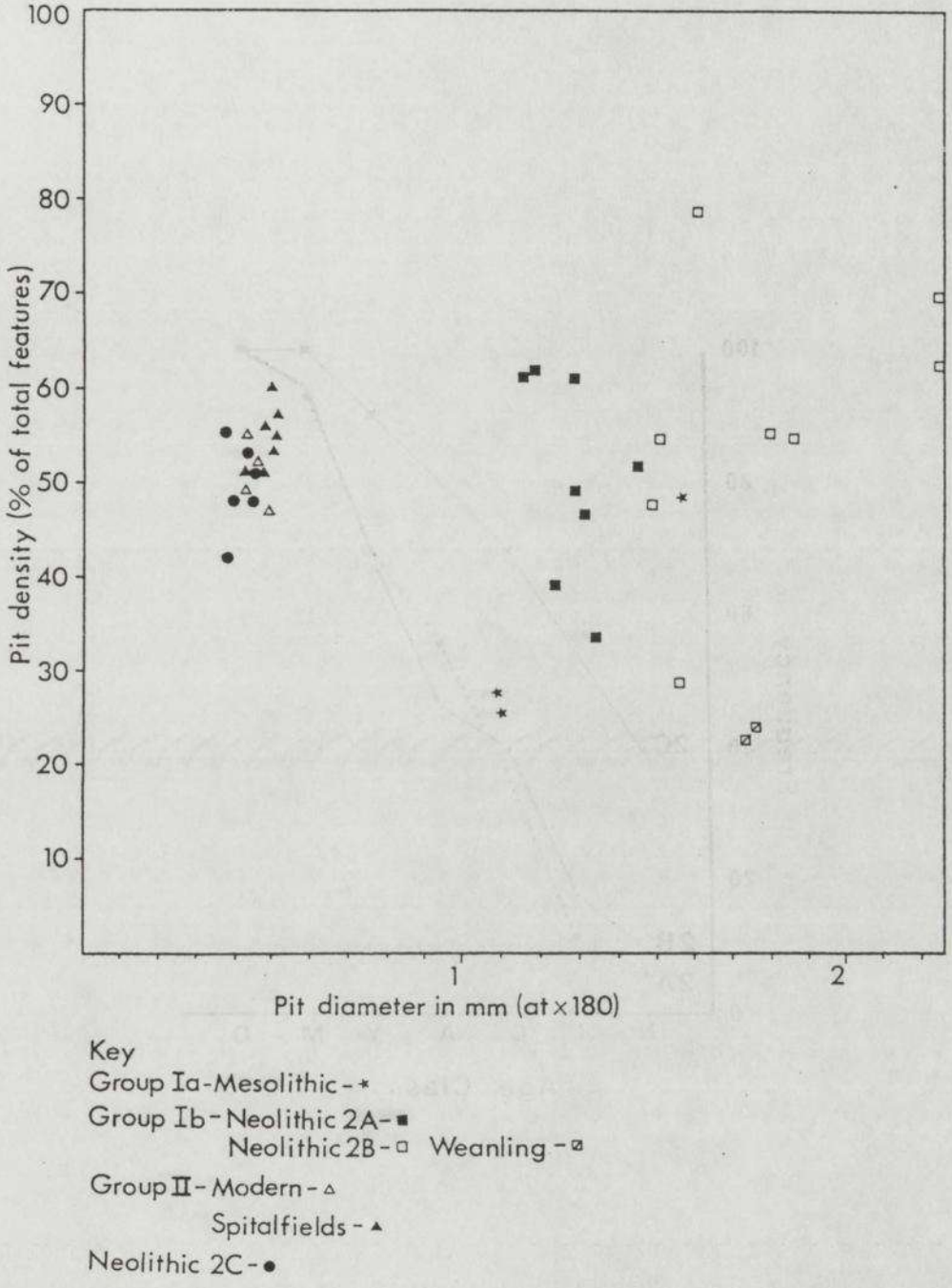

Fig. 3. : Pit size and pit density reflect size and hardness of food particles chewed by people of the aceramic Neolithic of Abu Hureyra.

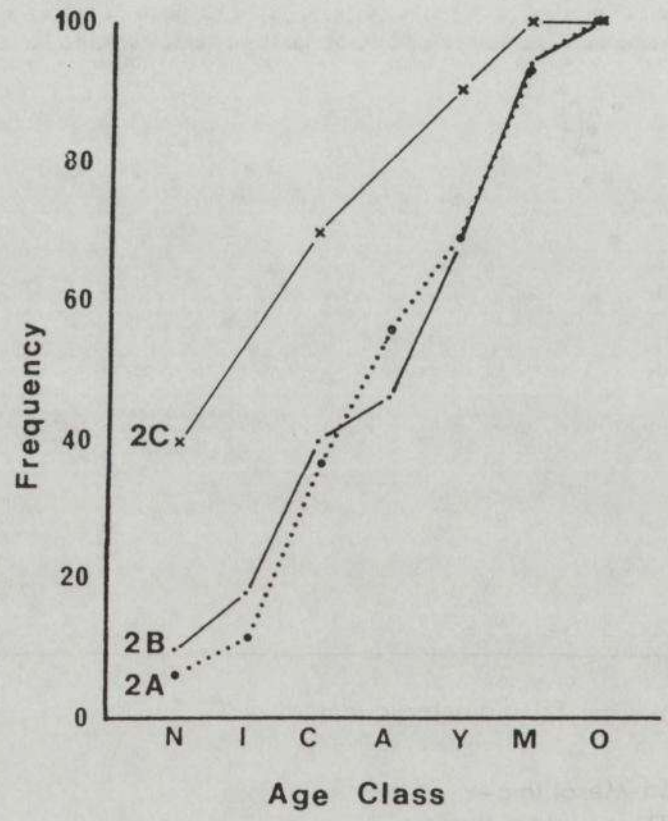

Fig. 4. : Cumulative curves of the relative proportions of neonate (N), infant (I), young child (C), adolescent (A), young, mature and old adult (Y,M,O) skeletons recovered from Neolithic phases 2A, 2B and 2C at Abu Hureyra. There is a marked increase in the proportion of juveniles from 2C levels.