

Did Man Once Live by Beer Alone?

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[515] This is the second in a series of symposia the object of which is to expedite scholarly intercommunication. Robert Braidwood's query was referred to several colleagues for comments which were sent to Braidwood for rejoinder; then the series was edited as a whole. Similar queries in any field of anthropology, or at the margins, are invited, and the author may suggest names of persons whose comments he would value.

Query by Robert J. Braidwood

It is generally assumed that the appearance of domesticated cereals in the Near East was intimately linked with the use of these grains for the preparation of flour for bread making. Recently Professor J. D. Sauer of the Department of Botany of the University of Wisconsin has queried this generalization in relation to our preliminary notices on Jarmo et al. (cf. Braidwood: *Scientific American*, Oct. 1952, pp. 62-66; *The Near East and the Foundations for Civilization*, University of Oregon Press, 1952). Sauer wonders whether the earliest utilization of the domesticated cereals may have been for beer rather than bread. The question would thus appear to be: Could the discovery that a mash of fermented grain yielded a palatable and nutritious beverage have acted as a greater stimulant toward the experimental selection and breeding of the cereals than the discovery of flour and bread making? One would assume that the utilization of wild cereals (along with edible roots and berries) as a source of collected food would have been in existence for millennia before their domestication (in a meaningful sense) took place. Was the subsequent impetus to this domestication bread or beer?

The contemporary archeological evidence from the area which bears on the point would be, in order of appearance: Natufian of Palestine-sickles (reaping, but no direct implication of planting), mortars and pestles (mortars small, with conical sections, probably for ochre or bone grinding); Karim Shahir of Iraq adds-celts (used as hoes, or as axes, or both?); Jarmo of Iraq (and in fair part Jericho XVII-X of Palestine) adds-grain (two wheats and a barley, in process of being bred), querns and rubbing stones, built clay ovens with smoothed fire-hardened floors, receptacles in the form of baked-in place clay floor basins, stone vessels, and bitumen-coated basketry (??); uppermost Jarmo of Iraq and Jericho IX of Palestine add-pottery. From this point onwards the familiar early village sequence proceeds.

It will be seen that this direct evidence, as now available, is of no particular use in solving the question either way. The cereals themselves, and the tools for planting and reaping, would be involved for either the bread or the beer: so also, probably, would the milling stones. The receptacles for liquids obviously need not imply beer alone. When the grain itself is recovered (and not [516] the hollow casts of grain in clay, which Helbaek has so successfully used for identifications) the kernels are invariably charred. A question arises as to whether these charred kernels may have been overfired accidentally in the parching process by which the malt was prepared, although I have seen grain parched for other purposes.

I am myself in no way unattracted to the idea, as Sauer put it, that "thirst rather than hunger may have been the stimulus behind the origin of small grain agriculture." Do any of our colleagues recall tools or processes in either beer or bread making which might be expected to persist in the archeological record and which would lead to further understanding of the point?

Comments

by Jonathan D. Sauer

The pioneer cultivators of wheat or barley must have been faced with a pitifully small return of grain for their labor. Yields of the primitive grain crops must have been poor, even after the development of cultivated forms which retained the ripe grain in the head, instead of shattering the inflorescence and scattering the grains on the ground when ripe, as do the wild wheats and barleys. Planting and harvesting small grains without the plow or other efficient tools would seem to me a game scarcely worth the candle except for a more rewarding stake than mere food.

One of the most suggestive pieces of evidence is the constant confederacy of barley and wheat in the early finds in general, encountered again at Jarmo. In primitive agriculture a dual grain crop is remarkable enough to require some explanation and it seems to me easier to account for in terms of a beer recipe than in terms of carbohydrate foodstuff. Of course it is possible that in the beginning only one of these grains was the deliberately planted crop, while the other was tolerated as a volunteer which had entered the fields as a weed. It is clear that during the Neolithic and later times, as the cultivation of barley and wheat spread, various local grasses moved into the fields as weeds, migrated with the crops, and were gradually modified by accidental hybridization and selection in the normal processes of cultivation and harvesting. The story is well known of how such unplanned events among the weedy invaders of barley and emmer wheat fields gave rise to domesticated oats and rye as well as to the more recent wheats and barleys.

It takes little imagination to extrapolate this process back to earlier times and suggest the possibility that the entire complex of western small grain agriculture may be the outcome of just one case of deliberate domestication of a wild grass. If so, barley may have been the original crop and cultivated wheat may have evolved from weed grasses in the barley fields. Recent botanical evidence suggests that the original home of the first domesticated barley was [517] not in the Near East but the Far East, possibly Tibet. Thus it is conceivable that the lowest agricultural levels in the Near East represent a stage in the westward movement of an agriculture which had started well to the east, perhaps with the domestication of barley, and had picked up wheat as it spread into the Near East. This possibility does not detract from the thesis of brewing as the basis of early agriculture, since it is barley that is critical in making beer and wheat is quite dispensable.

Incidentally, a corollary of this argument that may not occur immediately to everybody is that the oldest domesticated plant may be yeast.

by Hans Helbaek

The suggestion put by Professor Sauer and commented upon by Professor Braidwood raises a most fascinating problem-if a most unapproachable one. In spite of the deplorable fact that the Jarmo material does not in any way sustain a discussion along these lines I shall be pleased to comply with your wish for a comment.

One would spontaneously conceive brewing as later than bread making - in its widest sense - in the technological sequence, in the same way as one would be apt to suggest that the first cattle were domesticated for food- meat and milk-rather than for making intoxicating beverages from the milk. Implements for brewing would hardly be specialized to such a degree in these early days that we could determine their exact purpose, to the exclusion of other alternatives. Of course we may point out that a large vat would be useful in the malting process, but we cannot exclude its possible employment otherwise, and a stick might be perfect for stirring the malt when drying-but, well, now I am touching the sore point of archeological interpretation. Even the presence of germinated grain should not inevitably lead to the conclusion that it is malt, as germination may well happen unintentionally in consequence of unfavorable storage conditions. The interpretation of germinated grain found in prehistoric sites may depend upon a complex of criteria.

As for the carbonization as such being an indication of activities connected with brewing, I would like to point out that every deposit of grain but one known to me contradicts this view. If you will allow the space I shall try to explain this point.

Theoretically brewing consists of the conversion of starch into fermentable saccharine compounds which eventually, by the action of yeast organisms are divided into alcohol and carbon dioxide.

In practice brewing from grain is performed in two stages, the malting and the fermentation. The former process deals with the living grain, in the latter the grain as such is killed. Only the first or malting process is relevant to the question in hand.

[518] The conversion of the main substance of grain, the starch, is brought about by stimulation of the natural germination of the grain. By generous administration of moisture and fresh air, and moderate heat, the germination is started. During this process the grain itself develops an enzyme, diastase, which converts the starch into fermentable sugars. After a few days the germination is discontinued and the germ is killed by heat-but nothing amounting to carbonization, which would be destructive to the purpose of brewing. The subsequent measures would hardly be identifiable in carbonized material, and we shall confine ourselves to considering the malt.

As carbonization cannot be employed in malting, carbonized malt must be the result of an accident, and if, as in Jarmo, we find only ungerminated grain it does not bear on the point at all. Carbonization may happen in a multitude of ways, for instance by the grain having been spilled into the ash at the fireplace during cooking activities. In prehistoric times - as still today - house fires afforded beautiful opportunities for large quantities of grain to be carbonized. In this connection it should be pointed out that only the dry desert climate, as for instance in Egypt, would allow farinaceous plant parts to be preserved if not carbonized. In Jarmo all uncarbonized grain would be destroyed in a short time by putrefactive microbes, and this would be the case in any area in which the climate allowed agriculture on basis of the rainfall. For this reason the "spontaneous combustion" of grain, now and again postulated in the archeological literature, is pure nonsense. Fire must always have been involved.

However, the priority of bread making or brewing as the stimulant towards plant breeding is a problem much too complicated to be solved simply by the interpretation of archaeological material and subsequent speculations. Folklore and ethnology must be drawn into the discussion to pay the matter due respect.

As two of the foremost European authorities on the subject of preparation and utilization of cultivated plants in the past and in various parts of the world, A. Maurizio, the Polish agricultural botanist, and Gudmund Hatt, the Danish ethnologist and archeologist, have contributed to the discussion of the question in an excellent way, I can do no better than refer to their conclusions.

Maurizio (in *Die Geschichte unserer Pflanzennahrung von den Urzeiten bis Zur Gegenwart*) expresses the view that the pouring of water upon a vegetable foodstuff, making some kind of suspension, extract or solution (Aufguss), is an elementary and exceedingly old way of preparing food, and almost all kinds of dishes originate from this elementary process. One line of development leads via gruel and porridge to bread; another line, employing fermentation, leads to beer, wine, and stronger alcoholic beverages.

If brewing was the primary utilization of cereals from the beginning it should be expected that diffusion of agriculture first and foremost was mani[519]fested by spreading knowledge of brewing. But this, as shown by numerous examples, was not the case. Let me quote an example from Gudmund Hatt: "In the southern part of Central America and in South America maize is used not only for bread, but also for making beer. A kind of malt is made by letting the maize sprout, and the fermentation is started by chewing the grain... While maize beer is also made by semi-agriculturists east of the Andes, other tribes make an intoxicating beverage from cassava bread. Some of the semi-agriculturists do not know how to make beer at all, and it is likely that this art belonged originally to the maize-cultivating full-agriculturists of the Andes... North of Mexico it seems that no alcoholic beverages were made in pre-Columbian times." (Curwen and Hatt: *Plough and Pasture: The Early History of Farming*).

Thus, in my opinion, the indirect evidence regarding our problem is in favor of bread being the first stimulant for agriculture; the evidence for the opposite solution is nil.

by Paul C. Mangelsdorf

The idea that brewing antedates bread making is, of course, not new. At least one earlier student (Death) has called brewing the oldest of the arts and has even contended that it preceded the use of fire.

A fairly good case might be made for an earlier utilization of cereals for brewing than for bread-making, not because thirst was a stronger motive than hunger, but because the earliest grains available were more suitable for beer-making than for bread. The earliest cereals of the Near East - the wild wheats, *Triticum aegilopoides*, *T. thaouidar*, and *T. dicocoides* and their cultivated counterparts, *T. monococcum* and *T. dicocum*, and species of barley-are all characterized by the adherence of the glumes (husks or chaff) to the grains after the grains have been removed from the heads. Such glume-enclosed grains are, without additional processing, virtually useless for bread-making but all can be used for brewing and one, barley, is the cereal par excellence for this purpose.

But having made a case for the antiquity of brewing one finds several questions immediately arising. If these ancient cereals were not used for food, what did their gatherers or early growers feed on? Man cannot live on beer alone, and not too satisfactorily on beer and meat. And the addition of a few legumes, the wild peas and lentils of the Near East, would not have improved the situation appreciably. Additional carbohydrates were needed to balance the diet. No carbohydrate-furnishing plants were naturally available in this region, according to Vavilov, except the cereals. Did these Neolithic farmers forego the extraordinary food values of the cereals in favor of alcohol, for which they had no physiological need? Are we to believe that the foundations of West[520]ern Civilization were laid by an ill-fed people living in a perpetual state of partial intoxication?

And for what purpose were the ovens used? Parching is not a part of the malting process; indeed, it is an infallible preventative of malting. To make an alcoholic beverage from cereals the starch must first be converted to sugars by enzymatic action. This may be done by one of three methods-

germination, salivation or fermentation. In the first method the sprouting grain furnishes its own enzyme, diastase; in the second the primitive brewer supplies the enzyme ptyalin from his (or her) own saliva; in the third the enzyme is derived from the fermenting organism, usually a fungus. In all three methods the enzyme would be destroyed by the heat employed in parching. The beer-making of the Near East probably involved the first of the above methods, germination. Parching as an initial step would have completely prevented germination; applied following germination it would have inactivated the enzyme, diastase.

A test of the brewing theory might be provided by the prehistoric grains themselves, or by their impressions in pottery. Is there any tangible evidence of an early practice of sprouting grains? We have examined prehistoric grains from both Jarmo and Mattarah and find no evidence whatever of germination. Other collections might perhaps be profitably examined from this standpoint.

Perhaps the earliest beer was less sophisticated than modern beer and was made from ungerminated grains by fermenting the small amounts of sugar which occur naturally in cereals. Such a beverage would have had a very low alcoholic content and should perhaps appropriately be called not a beer but a gruel; not an alcoholic beverage but a food. The Hawaiian poi is such a food.

I suggest that the earliest cereals were used neither for brewing nor for baking, but as popped or parched grains. If cereals, in which the glumes adhere to the grains, are a regular and substantial part of the diet, it is necessary to remove the glumes in some way; otherwise the intake of indigestible cellulose is too high for the well-being of the human digestive tract. In all parts of the world people have learned to remove the adhering glumes of cereals by heat or fire. If the cereal is corneous and has a proper moisture content the grains, when exposed to heat, will explode or "pop" and escape completely from their enveloping glumes. In such cereals simple exposure to heat is a substitute for three modern processing operations: hulling, milling and baking. In America the earliest use of maize appears to have been for popping; popped kernels have been found in the remains of Bat Cave. In India certain varieties of rice are popped by stirring the kernels in hot sand, and many Indian villages still have a village popper who processes the rice by this primitive method and takes his toll of the product.

If the cereal is not corneous enough to pop, heating at high temperatures [521] will char the glumes allowing them to be rubbed off. The Chippewa Indians still employ this method in processing wild rice, first heating the rough rice, then removing the charred glumes by tramping the grains in a hollow log: a mortar with a human pestle. Clark described a practice in parts of Scotland of burning off the glumes of cereals by setting fire to the unthreshed heads.

If the heating is carried far enough to char the glumes the kernels undergo some degree of parching and are much more easily chewed or ground than the raw grain. We have experimented with grains of barley, einkorn and emmer which, in the raw state, are almost impossible to chew, but which, once their glumes have been charred and rubbed off and their grains slightly parched, are easily masticated and are quite palatable.

The next step, taken, perhaps, to meet the needs of the partly toothless members of the community, both old and young, was to render the grains still more easily masticated by grinding them coarsely and steeping the resulting meal in water. Kornicke states that the Greeks rarely used barley for bread. It was roasted and coarsely ground, originally perhaps for easier mastication, but later for preparing a gruel with water. The product, alphita, was the equivalent of daily bread for large segments of the population.

The practice of making gruel might easily have led to brewing and baking, since a gruel may undergo mild fermentation and since in both brewing and baking fermentation is an important

factor. However, a possible intermediate step, the making of unleavened bread, should not be overlooked. Unleavened breads, made from all kinds of cereals, are used throughout the world. It is easy to imagine an historical sequence which involved (1) unleavened bread, (2) bread, leavened with yeasts, (3) beer, fermented with yeasts. The sequence (1), (3), (2) would not be completely improbable; the other four possible sequences are more difficult to imagine.

Since we are, in any case, dealing with largely untestable hypotheses may I suggest the following as a possible sequence of evolutionary steps:

1. Parched or popped cereals cereal-heat.
2. Gruel cereal-heat-grinding-water.
3. Unleavened bread = cereal-heat and/or grinding-water-heat.
4. Leavened bread = cereal-heat and/or grinding-water-yeast-heat.
5. Beer = cereal-sprouting-drying-grinding-water-yeast.

This hypothesis is admittedly somewhat prosaic and involves nothing more profound than the assumption that evolution, more often than not, proceeds from the simple to the complex. The hypothesis does have the merit of being supported by one bit of tangible evidence: archeological remains of well-parched grains. One further point; H. P. Lutz in *Viticulture and brewing in the ancient Orient*, described the making of beer from half-baked loaves of leavened bread. Here is one instance, at least, where bread is more than a precursor to beer; it is the principal ingredient.

[522] by Hugh C. Cutler

It is likely that the use of cereals for both bread and beer was important as a stimulus to selection and breeding of cereals in the early days of agriculture. As bread or beer, grains are more palatable than raw or parched grains or even as parched grain beverage or as porridge. It is likely that before agriculture was developed man already prepared unleavened bread, beer, and may even have occasionally produced leavened bread by accident. While it would be difficult to find evidence that alcoholic beverages were prepared before the invention of agriculture, the large number of wild growing materials used for beers, the simple methods involved, and the many groups of people who prepare beers support such a belief. Probably the best known wild materials used for beer in the New World are the pods of algarroba and mesquite, fruits of the pepper tree, saguaro cactus, murity palm, and wild pineapple. I wouldn't be surprised if some wild growing grasses were used in the Old World. I doubt if one can consider the yeasts involved as the first domesticated plants because they are not consciously planted or maintained free from competition with other Organisms. Many different kinds of yeasts were involved, as well as molds and bacteria. Early beer yeasts can be considered weeds, like the weed potatoes which grow on the margins of Bolivian Indian fields and are tolerated and the tubers harvested, although the Indian does not know how the weed potatoes arrived there.

I would expect to find some kind of vessels although these need not be large and might be of perishable materials like skin. Takana Indians of Bolivia use jars which may hold as little as one gallon, although the usual size is two or three gallons. I would not expect to find malting in the earliest beer making, although it is likely that parched grain was used early because it is more readily ground and beer might have developed from a parched grain beverage which fermented accidentally. It would be difficult to find early evidence for chewing grains for beer unless dental-plate-like masses of salivated grain (the "muko" of Bolivian Quechua Indians) are found.

by Carleton S. Coon

One of the earliest ways of preparing cereals for food has been omitted entirely, and another barely mentioned. The first is porridge. Mortars take precedence over grindstones archeologically. All over the Middle East people eat some kind of porridge as a family dish, easier to prepare than bread which, before the invention of metal, required a communal oven. Such ovens occur in the painted pottery stage, but apparently not before. In the Americas maize porridge is a familiar food throughout the agricultural regions. In South and Central America, maize porridge is converted into the well-known chicha, a form of beer. In the agricultural regions of the United States both porridges [523] and bread were prepared and eaten by the Indians, who made no beer. The relationship between beer and bread established in the Old World involves raising the bread with yeast, an agent of fermentation. You cannot raise maize dough unless it is mixed with wheat. So this functional relationship is lacking in the New World, but still some of its inhabitants made beer. The Indians of North America are culturally marginal to those of Central and South America, and may be presumed to follow the older pattern. If they had known how to produce an intoxicant it is hard to understand why they would have given it up voluntarily. Furthermore, the Indians of California were in a Mesolithic cultural stage, using wild seeds. They parched them and porridged them, but did not brew them. In my opinion the fermentation of beers, in the Americas, probably FOLLOWED bread as well as porridge making and parching.

In the Old World the latest surviving Neolithic culture of Middle Eastern origin was that of the Guanches of the Canary Islands, whom the Spaniards conquered in the fifteenth century. The Guanches raised wheat and barley. They parched these grains, after pounding or grinding them, and ate the resultant goffio as a staple. This is still used among the Moroccan Berbers as an emergency food and wartime ration. The Berbers also make porridge, and steamed coarsely ground wheat (seksu). In the mountains the tradition is that bread was not commonly baked until recent times.

The Guanches made no beer, or other intoxicant. The Berbers made wine right through the Muslim period, and some of them still make it. There is no beer made in North Africa today, except by Europeans, and no mention of it in the abundant historical record, at least in what I have read. If the Berbers had made beer I think we would have known it. In the Old World as in the New, the old peripheries are beerless. I do not think that the problem can be solved in its present stage since on one side the evidence is partial, on the other lacking. However, I believe that the bulk of the ethnological evidence runs against the theory of the priority of beer.

In summary: The archeological side, as represented by Braidwood, has some concrete evidence, but it is not enough. The botanical side, as represented by Sauer has no evidence which I am qualified to understand. The evidence of history and comparative ethnology favors Braidwood, but it is not conclusive.

by Ralph Linton

I would take an intermediate position in the beer vs. bread controversy. From the types of cereal usage current among marginal groups such as Celts, Bantu and N. Chinese it would seem probable that the earliest usage of cereals was as cracked, toasted grits or as mush. Bread can be shown to be later at least for Greece, cf. Homeric poems. Leavened bread is, of course, later still and pretty certainly post beer. Hard to see how the use of yeast could have [524] been discovered otherwise. One suspects that beer itself may have resulted from accidental souring of a thin gruel made from sprouted grain which had been left standing in an open vessel. The fact that all the grain recovered is charred may well be due to the removal by decay of kernels not transformed to inert carbon. As regards implications of tools, rather finely ground flour is required for bread making. It is almost impossible to produce this with mortar and pestle and difficult to make it with rubbing stones unless grain is worked over repeatedly on finer and finer stones as in S. W. Indian "piki" bread. Most of

European Neolithic querns and metates are relatively coarse, adapted to manufacture of grits rather than flour.

by Julian Steward

Since the distribution of grains and other cultivated crops in the New World is much wider than fermented beers, I would think that the beers came later but admit this is poor proof of the historical sequence.

by A. Leo Oppenheim

In my booklet "On Beer and Brewing Techniques in Ancient Mesopotamia" (published as a Supplement to the Journal of the American Oriental Society, 1950), I have given considerable attention to the complex technological developments leading to the brewing of barley-beer. The investigation of the pertinent Sumerian and Akkadian terminology has shown that the preparation of vegetable food stuffs (not only cereals), without the application of fire, developed into the manufacture of pulpy dishes (gruel)-made palatable by seasoning or by sour fermentation-and of "preserves" (such as malted barley, etc.). These techniques led then to the baking of barley-cakes as well as to the brewing of several types of beer-like beverages. Thus, the cuneiform text-material which covers more than three millennia with an abundance of references-often reflecting even the developments of the preceding pre-literate period suggests the quest for food (preparation-as well as conservation techniques) has acted as a primal incentive for the utilization, selection and eventual domestication of the cereals.

May I, as an outsider, suggest here that the necessity to preserve the harvested crops constituted an important stimulus yielding many novel techniques which decisively influenced the history of food-preparation. This holds especially true for fruits (dates, grapes, apples, berries, etc.) which show a development via "preserve" to alcoholic beverage which technologically parallels that from grain to beer and might well have served as a prototype for the latter because the utilization of such fruits necessarily must have preceded that of grains. Again, the cuneiform material offers us in its technical terms, records, [525] and lists, an impressive amount of pertinent information which will shed, if adequately studied, light on technological developments which we otherwise would have to reconstruct solely on the basis of tenuous hypotheses.

This observation induces me to make use of the rare opportunity given to an Assyriologist to reach the scholars beyond the narrow boundaries of his discipline. I would like to bring to the attention of the anthropologists the fact that the early "literate" civilizations, especially Mesopotamia, through the imperishable nature of its writing-material, have preserved a wealth of important anthropological information which will come to light and to life only if the two disciplines cooperate. Neither the Assyriologist with anthropological "interests" nor the anthropologist who attempts to gather some "information" from the so-called handbooks can achieve valid results. A planned interdisciplinary approach, however, is bound to yield a rich harvest of important information, and to act as a mutual stimulus.

Rejoinder

First it seems that I should clear up the implications of the first paragraph of my original query. By "domestication (in a meaningful sense)," I mean the establishment of a level of food-production of such efficiency that a primary farming-village community may result. I cannot test the various

botanically based claims of the Sauers (père et fils), Schieman, Anderson, et al., for "domestication" in further Asia, but I do believe the archeological evidence points to "nuclear" Western Asia (the hilly flanks of the fertile crescent) as the region in which effective food-production and the appearance of the village community first took place.

There was very probably an earlier phase or two of established village life, before that indicated by the Jarmo materials. Jarmo simply happens to exhibit what are apparently the earliest comprehensible remains of a village establishment which we now have in hand; the basal levels of Jericho may prove to be equivalently early (C14 samples from Miss Kenyon's competent new exposures at Jericho are now en route to Chicago). Karim Shahir may belong to one of these postulated pre-Jarmo village phases, but its "villageness" is not yet very comprehensible. If the earliest Near Eastern beer was brewed from germinated grain malt as Mangelsdorf thinks probable, and as Oppenheim's study (op. cit., pp. 13-16) indicates was customary in later times, then we have no evidence of the process at Jarmo. Neither Helbaek nor Mangelsdorf, who have examined the Jarmo grain samples, found traces of germination.

Most of the respondents suggest the original use of the cereals to have been that of a food, prepared as a gruel. In connection with Sauer's point about the shattering of wild grain when reaped, I know of at least one small [526] village in northwest Syria where the standard Near Eastern burghul (wheat grains which are first boiled, then sun-dried, cracked into grits, and finally served as a hot mush-like dish) is prepared from wheat which is not quite ripe. Another case of the use of green kernels is shawi, in which full-sized but still somewhat green wheat is parched (it does not fully pop) and eaten immediately as a sort of delicacy on festive occasions-much in the way we use popcorn. This would all fit in with the notion of gruel, and even with Mangelsdorf's pre-gruel popping stage. Such could explain the ovens with hard-baked flat floors at Jarmo, and also the quantity of overparched (accidentally carbonized) grain.