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were found in the oldest fireplace and 2 in the youngest. Macroscopically, all fragments showed a starchy, often vitrified, microstructure and irregular porous matrix, indicative preserved in archaeological sites and provide empirical data on of well-processed food components Fig. The average size of the remains was between activities that would otherwise be very difficult to characterize. The basic classification system based on height mea- categorized as bread-like. The analyses carried out involved surements suggests that they probably represent unleavened flat general description of the remains i. This idea and inclusions using low-magnification microscopy, and their is supported by the size of the voids. The size of the voids of the bread-like remains from characterization of the matrix number and types of voids 2, Shubayqa 1 was 0. Neolithic and Roman age sites in Europe and Turkey 2, 11, The site of Shubayqa 1 showing Structure 1 and one of the fireplaces the oldest one where the bread-like remains were discovered. Scanning electron microscope images of bread-like remains from Shubayqa 1. A Sample number 6 showing the typical porous matrix of bread with small closed voids. B Detail of an aleurone layer from sample number 17 at least single celled. C Sample number 12 showing vascular tissue, the arrow marks the xylem vessels in longitudinal section for additional images of the remains see SI Appendix, Figs. The Plant Ingredients seeded grasses in Shubayqa 1 is supported by the assemblage of In terms of the ingredients used in the food preparations from plant macroremains found in association with the food remains. From the 24 fragments, 15 showed cereal This pattern is caused when the grains are ground before char- tissue, primarily pericarp tissue longitudinal and transverse cells ring 16 , and it is commonly linked to food production activities or bran layers , endosperm cell structures aleurone layers Fig. S2â€”S4 , and starch-containing therefore suggests that several large-seeded grasses were most cells SI Appendix, Fig. Fragments of longitudinal and probably used in the food preparations from Shubayqa 1. In tissue, and root-type starch Fig. S5â€”S7 five of the remains, cereal grain cross-sections were identified. At and S10 and Tables S2 and S3. The vascular tissue preserved least two specimens showed single-celled aleurone layers, typical represents most likely club-rush tuber B. Ethnobotanical and exper- layered aleurone found in grasses such as barley *Hordeum imental* evidence indicates club-rush tubers are best consumed as cannot be completely excluded. In one of the remains analyzed gruel or flour to make bread, instead of boiling or steaming 18, for starch *Avena*-type was identified within the ingredients SI Pure club-rush tuber bread is brittle, crumbly, and flaky, but Appendix, Table S3. The processing and consumption of large- the addition of bread wheat *Triticum aestivum* flour i. PNAS Latest Articles 3 of 6 gluten allows for the production of elastic dough that can be digestion, and produce a particular taste The food remains pressed onto the walls of a tandir-type oven structure and be were found in two in situ fireplaces, suggesting that the inhabi- baked Evidence for cereal and club-rush tuber preparations tants of Shubayqa 1 produced bread-like products shortly before have been identified at late Neolithic sites in Turkey 2 and The they abandoned the site. Its production could therefore be Netherlands The finds from Shubayqa 1 suggest a consid- interpreted as a means of stocking up a rather light, nutritional, erably earlier date for their dietary use. Bread involves high pro- Products in Shubayqa 1 duction costs, including thorough dehusking and grinding of the The measured sizes of the cereal and noncereal components cereals, as well as kneading and baking 5. The metrical analyses of the particles from Shu- interpretation finds some support in the archaeobotanical re- bayqa 1 show sizes between 0. A total of The overall number made the bulk of the diet 10, 39â€”42 , with cereals being of measurable particles found in Shubayqa 1 is low, but the re- exploited to much lower extent, especially in comparison with sults indicate larger proportions of flour-type particles than later Pre-Pottery Neolithic periods Consequently, and in bread-like remains at later Neolithic sites e. It is possible that the flour used to make the bread-like remains at Shubayqa 1 was meticulously ground and Natufian. The exploitation of cereals increased gradually be- carefully sieved to obtain a consistency similar to modern flours. At 1 has yielded the largest assemblage of ground stone tools from around 9 ka cal BP, domesticated cereal economies become secure late Epipaleolithic contents in the southern Levant 8. This would suggest that bread was suggests that the inhabitants were skilled in processing raw ma- transformed from a special occasion food to a daily staple when terials such as plants. Starch analyses of the remains shows

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that five of the six remains analyzed had little or no starch, whereas one showed good preservation. The previous studies have associated the production of bread with absence of starch may be the combined result of grinding and fully fledged agricultural groups of the Neolithic period. How- baking as wet dough, as well as charring. These processes would ever, the discovery of charred food remains at Shubayqa 1 provide direct empirical data for the production of bread-like depositional processes and hydrolysis. Evidence for foodstuffs before agriculture emerged in southwest Asia. Like- Baking represents an important step forward in human subsistence and nutrition, and we here demonstrate that Natufian peoples may also be explained by the carbonized state of the samples hunter-gatherers already practiced it. However, to explore when themselves. Indeed, several authors have suggested that carbon- baking of foodstuffs such as bread developed the systematic bonized food remains on the inside of prehistoric cooking pots analyses of charred food remains from contemporary, as well may provide a good microenvironment for the preservation of as previous Epipaleolithic hunter-gatherers sites should be carbon- starch and other microbotanical remains. The dough ried out in the future. Given the absence of oven remains provides firsthand and detailed information on the components at this site or others of this period, it is most likely that of human diet and cooking technology very difficult to achieve by dough was placed in the ashes of a fireplace or on a hot stone to other means. The addition of these lines of evidence will enable be baked. The modification processes that are involved in bread. The whole contents of the two fireplaces were retrieved and sampled for preparation. The dry sieving of the cellulose-rich chaff, improve starch accessibility and protein samples was carried out previous to flotation to pick out plant remains such as of 6. The initial analyses, including the general description and photography of. For this purpose, a small subsample was taken from each food sample, leaving the food fragments, were carried out using a stereobinocular microscope the larger portion for future analyses. A fraction scanned using a Zeiss Axio Imager. SEM observations of the food all of the slides to identify smaller starches and phytoliths. For not weighed, as there was no analytical balance available at the time of SEM observation, samples were cleaned from soil sediments with a brush to analysis. During the microscopic analyses, two main aspects were investigated: Andreas Heiss Austrian Academy of the matrix; and the examination of the microstructures, which are the Sciences for useful comments during the analyses of the food remains from outcome of the processing and cooking methods used for their preparation. Shubayqa 1, Joe Roe University of Copenhagen for the illustration of the. From the 49 remains, a total of 24 showed clear characteristics of bread in map Fig. The main edible plant tissues were considered and and Postdoctoral Grant to T. Permission to excavate at Shubayqa and tubers ; vascular tissues underground storage organs ; and starch 1 and export some of the remains for analysis was granted by the Department of Antiquities of Jordan. The raw data are presented in 17, 22, Popova T Bread remains in archaeological contexts. Southeast Europe and Dickson CA Experimental processing and cooking of emmer and spelt wheats to the study of archaeological cereal meals: Upper Palaeolithic revealed by starch grain analysis.

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