

Lower Paleolithic shaped stone balls were used for bone marrow extraction

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The presence of shaped stone balls (SSBs), also known as spheroids or polyhedrons, in early Paleolithic sites has attracted scholarly attention since the pioneering work of Louis and Mary Leakey in Olduvai, Tanzania. Despite the persistent production of SSBs for two million years, their function is still unknown. We present new results on the use of ten SSBs from the Middle Pleistocene (420–200ka) Qesem Cave, Israel based on use-wear and residue analyses, accompanied by a dedicated experimental program. The use wear and residue indicate crushing of fresh bone by thrusting percussion and provide direct evidence for the repeated use of SSBs to access fat-rich bone marrow of animal prey. These traces are as yet the only (and earliest) direct evidence of the use of this type of artifact. Our study indicates that inhabitants of Qesem Cave favored the use of shaped, somewhat angular, stone balls made of calcareous rocks to crush fresh animal bones to access marrow. The presence of use wear on the Qesem SSBs highlights this preference, as shown by SSBs with a patina and even broken SSBs that were selected from outside the cave and brought in for this specific activity. Our experiments demonstrated that SSBs are indeed efficient for bone processing, providing a comfortable grip and useful active areas with a number of suitable working edges for prolonged use. The morphology of SSBs and the specific manipulation of the tools, which were possibly turned around during the use, seem to have affected the use wear distribution throughout the surface of the tool. Our analysis and experimental use of replicas support, for the first time, linking functional and morphological traits of these intriguing Paleolithic items. Furthermore, experiments suggest that the distinct spherical morphology of SSBs is a result of a complex knapping trajectory, which required careful planning and necessitated a high degree of knowhow and precision. Moreover, experiments indicate that the level of experience in bone breaking and knowledge about bone anatomy affect the processing time of the bone. We thus infer that skill and knowledge were required in selecting adequate tools and using them properly for this task. These results shed new light on the function of Paleolithic SSBs and accord well with the significance of animal fat in the caloric intake of Middle Pleistocene humans at Qesem Cave and beyond.