

In previous issues of *Labyrinth*, we looked at ancient agriculture from the point of view of what was grown and how it was grown in the ancient world. Once stored, these products usually had to be processed in some way to make them a consumable commodity and it is this processing for use which will occupy us for the next few issues of this magazine.

As far back as Palaeolithic times, grains, nuts, roots and corn have been pounded into edible foodstuffs with considerable efficiency using only primitive mortars and pestles. In fact, so efficient was this simple invention that it remained in constant use right through Roman times to the first century AD and beyond, and is still used today in some parts of the world. There is a fair amount of evidence for this mortar and pestle arrangement from physical evidence found during excavations by Schliemann at Troy as well as on Greek vase paintings and in ancient texts such as the Bible (Proverbs 27:22).⁵ Once realizing how easy it was to grind the grain with the pestle as well as pound it, the next logical progression in the development of hand-mills was probably the simple millstone or *quern*, also called the *metate* or *metatl* in the Americas. While many ancient American and Asiatic peoples were satisfied with pounding their corn and rice into meal, Middle Eastern and early Greek civilizations tended to grind their wheat and barley into flour for bread. To do this, they used flat rectangular or slightly concave oval stones over which a second smaller hand-stone was worked back and forth to crush and grind the grain.

There is evidence from southern Greece as far back as Mesolithic and Neolithic times, spanning 10,000 to 5000 years ago, that millstones of different sizes, shapes and materials were used for grinding grain into edible flour. While pounding tough grains in mortars continued throughout the Neolithic era, millstones were also used at that time for grinding clay and paint pigments in Greece as well as sharpening points—diversified use for a simple milling device. These shallow stone hand-mills, known in various locations as grain-rubbers and saddle querns, are attested by much ancient evidence, including the Bible (Exodus 11:5), Cato in his work *On Agriculture* (10.4 and 11.4), paintings and sculptures from the 3rd and 5th Dynasties in Egypt, and illustrations from 5th century Greece. It is in Greece also, in the Classical period, that a major improvement occurred to the earlier saddle quern—a hopper or grain chamber was added to the top stone of the mill and a long narrow slit was provided in the base of this stone to allow the grain to flow onto a lower stone slab where it was

ground into flour. These "new and improved" hand-mills are well documented throughout Greece, Greek Italy, Egypt, Asia Minor and Syria. There is evidence from the 1st century BC that Roman farmers were using these hopper-rubbers with grooved grinding surfaces which had even greater grinding and cutting efficiency. Using a hopper-mill, the operator no longer had to stop the whole milling process when more grain had to be added to the quern—he or she simply had to ensure that the hopper was always filled with grain.

Although possibly invented as early as the 9th century BC in Syria, the next practical improvement to the mill in the Western world came in Classical Greece when a simple machine—the lever—was added to the simple mill—the hopper-rubber. In this way, logically enough, we get the lever mill. This device merely had the upper stone of the earlier hopper-mill attached to a long lever which in turn was pivoted on the grinding table at one end while the other free end was pushed backward and forward by the miller. This left one hand free to supply the hopper with grain and turned the whole operation of grinding grain into an easy mechanical process.

Further mechanization of the mill came perhaps as early as 100 BC when the millstones themselves were made circular instead of rectangular and a rotary action was consequently adopted. The addition of a single vertical peg to the edge of the upper of the two round millstones made the rotary mill a true mechanical innovation over the earlier simple mills. In some places, spokes were added around the outer edges of the circular top stone, but it was the single vertical handle turning the upper stone which allowed for an even and continuous rotary motion. Although the upper stone was pivoted at its centre over the lower stone, enough space was provided around this pivot to allow the grain to be poured down and onto the lower millstone where it was ground into flour, which in turn poured out the sides of the mill.

There is still considerable debate—well beyond the scope of these articles—over whether the larger rotary donkey-mill (to be discussed in the next issue of *Labyrinth*) predates the smaller rotary hand-mill or vice versa. By the 2nd century BC both the donkey-mill and the rotary hand-mill were in use. Predating this, however, Roman ingenuity in the 3rd century BC had already turned the round hand-mill into a practical and portable piece of field equipment for the army, where one hand-mill served five to ten soldiers. This same Roman ingenuity also developed the so-called Pompeian or large hourglass-shaped rotary donkey-mills. Continuing a long line of improvements, the Romans then turned to water instead of animal or slave power to turn the grinding operation into a commercial enterprise on a scale never before seen in the ancient world. It is this development of powered milling which we will look at in the next issue of *Labyrinth*.