

Historical and Archaeological Study on Olive Oil Production in Antiquity in the Eastern Mediterranean in Light of the 'Abdūn Press Installation

The Importance of Olive and Olive Oil in Literature and the Holy Books

1- The olive tree (*Olea europaea*) is an evergreen tree that has a broad trunk and very branched crown. Its leaves are leathery, of lanceolate to oblong shape. The small fleshy drupe fruits ripen and turn color from green to black five to six months after flowering in May. It is of the type of trees that live for several hundreds of years (Zohary 1962: 28).

It was one of the most valuable trees in the region from very early times as witnessed by references in ancient literature (Trever 1962: 596; Zohary 1962: 287). The olive tree boasts that its fatness honors gods and men "Shall I leave my fatness, by which gods and men are honored" (Judges 9:8-9). Because of its economic importance in antiquity it was called the king of trees (Jud. 9:8; Lasor 1986: 588; Danker 1986: 612; Frankel 1997: 182). A family blessed with many children was resembled to olive shoots which spring from the roots of the old parent trees (Ps. 128:3; Trever 1962: 596).

2- Biblical literature indicated the importance of the olive tree as a gift of God, and the possession of olive oil meant prosperity. Job and others longed for a day when the rock poured for them streams of oil or the vats should overflow with oil and wine (Deut. 33:24, Job 29:6, Joel. 2:24, Enoch 8:5; Danker 1986: 612; Lasor 1986: 589).

The olive tree and its oil played an important role in Mediterranean myth and metaphor (Lasor 1986: 588). God swore by the olive tree as well as the fig tree in a verse of the Holy Qur'an. Because of their multiple benefits to mankind, God raised their importance when He swore by them and by two sacred places: Mount Tūr of Sinai where Moses talked to God, and Makka, the focus and place of origin of Islam (at-Tin 95:1-3).

The marriage bed on which Odysseus finally collapsed was built of a massive olive trunk. It was an olive leaf that the dove brought back to Noah (Gen. 8:11) and a burning olive branch that served as the first Olympic

torch. At the Athenian festivals (the Panthenaea) held in Greece in honor of Athene the goddess, the prizes at athletic contests were beautiful vases filled with olive oil, and old men held, in the parade, olive branches (Harvey 1966: 176). Islam's oldest university is named az-Zaytūna (the Olive Tree). And even today, the Arabic idiom for a good man is as "pure olive oil".

3- Oil, wheat and wine were of the most important staples of life in the Near East in Biblical times. They were considered as the main provisions kept in the royal storehouses and as a gift of God (IKings 17:12, IIKings 4:2, 20:13, IIChr. 32:28, 11:11, Isa. 39:2, Jer. 31:12, Deut. 28:51, Ex. 23:11; Danker 1986: 12). On the same level of importance, olive oil was considered as a symbol of superiority and divine blessing, fertility, beauty, freshness and peace (Jud. 9:8-9, Ps. 128:3, Jer. 11:16, Gen. 8:11, Neh. 8:15). This same importance is also apparent in later times (Ross 1962: 592).

4- In the region of Syria-Palestine, oil was extracted widely from olives as it was mainly produced out of sesame in Mesopotamia (Ross 1962: 592). The widespread use of olives in this area led to the selection or preference of certain varieties of fruit above others for the production of certain kinds of oil, according to the sort of use. Farmers could even recognize the sort of trees that produced more oil. They could know that the good tree yielded from ten to fifteen gallons a year (Ross 1962: 592; Hestrin and Yeivin 1977: 29).

Uses of Olive Oil

The olive fruit used to be soaked in brine for a certain period of time and when pickled, eaten as it was, either green or black (Epstein 1993: 133; Zohary 1962: 287; Forbes 1978: 37). Extracted oil had several uses, such as:

1- For food: It was used as a fresh food and for cooking. There are some references in the Bible (Jth. 10:5, Num. 11:8; Ross 1962: 592). Written sources from Ugarit in the Late Bronze Age and from north Palestine and Arad in the Iron Age relate that in the Levant, olive oil was

extensively used in the diet in these periods (Frankel 1997: 182).

- 2- Lighting and ritual practices: Oil was the main fuel for illumination. Since, in the collecting vats, the top layer of oil when skimmed off was pure, it was prescribed for lamps of ritual purposes because they were destined to burn continually in temples and sanctuaries and was used in other continuous burning offerings (Exod. 27:20, 29:49, Lev. 24:2, Num. 28:5; Ross 1962: 592).
- 3- In consecration: The sacred anointing oil was used to consecrate kings as well as priests, but not used by normal people. This consecration was attested by kings of ancient Egypt, and later on it was practiced in Palestine. Moreover, Jacob consecrated the stone at Bethel by pouring oil on it (Gen. 28:18, Exod. 30:26-30, Kings 19:16; Thompson 1962: 595; Watt 1995: 1209-1210). Moses was instructed to use myrrh, cinnamon, aromatic cane, cassia and olive oil to make a special consecrating anointing oil holy to Yahwa "It was to be used for the consecration of the tent of meeting with all its furnishings... Any use of it for ordinary men was a grave offense" (Ex. 30: 22-33; Birch 1986: 586).
- 4- Anointment: Olive oil was used for anointing different classes of the community of the region of Syro-Palestine. In Mesopotamia sesame oil and animal fats, and in Egypt almond oil and animal fats were substitute bases for ointments. The Hittite sources mentioned the anointing with oil, and those sources refer to anointing the bones of the deceased after cremation (Frankel 1997: 182; Thompson 1962: 593; Ross 1962: 592).

Olive oil was called the "oil of gladness", and anointment with it was stopped in Palestine only in the days of mourning or sorrow. Anointing with olive oil was a symbol of the blessing of God. Jesus, being anointed, urged the people to anoint their heads as usual during fasting (Matt. 6: 17; Watt 1995: 1209-1210). Warriors anointed their shields as a religious dedication and to protect the leather. Stellae were sanctified by anointing them (Gen. 28: 18, 35:14, Deut. 33:24, ISam. 10:1, 16:1, IISam. 1:21, 14:2, IIKings 9:6, 11:12, Lev. 8:30, Isa. 61:1, 21:5, Ps. 45:7, H 45:8, Prov. 27:9).

In the dry climate of the Near East, anointment with olive oil was a common practice and especially necessary after bathing. It was a sign of honor. Men used sweet ointments to attract the other sex. A guest should be anointed, and it was normal for a person to anoint his neighbor, and it was a mark of honor to anoint the head of the guest (Ps. 23:5, Eccl. 9:8, Matt. 6:17, IISam. 12:20, Ps. 23:5, Amos 6:6, Luke 7:46, Song of S. 1:3; Ross 1962: 592).

The value of ointment was tremendous. It was so valuable to kings and others to the degree that led to the inclusion of ointment with the treasures of King He-

zekiah. Egyptian banquet scenes display the guests being anointed with oil (IIKings 20:13; Thompson 1962: 594).

- 5- As a perfume base: Various perfumes used to be added to the olive oil. It is said that in cases where olive oil was mentioned in literary sources with a descriptive adjective it meant that the oil was perfumed. An example of such a description is "fragrant" (Thompson 1962: 594; Moulder 1986: 585-586).
- 6- Offering and sacrifice: It was offered for continual burning in religious places. On the other hand, all cereal offerings were to be provided with oil. Moreover it was served as part of meal offering and with animal sacrifices (Lev. 2:4, 24:2, Exod. 27:20, 29:40, Num. 28:5, 15:1-16).
- 7- For medical use: Biblical literature mentioned the widespread use of oil in healing, as it had the effect of softening the wound. Elders used to pray over the sick and anoint him. Sometimes the wound was washed with a mixture of wine and oil as a kind of God's protection and blessing for healing (Isa. 1:6, Mark 6:13, Jas. 5:14, Luke 10:34, Jer. 8:22; Ross 1962: 593; Thompson 1962: 595).
- 8- For trade: As an important product of different uses, olive oil was exported along with other food products such as wine, wheat and honey, "...they make a covenant with the Assyrians, and oil is carried into Egypt" (Hos. 12:1). At the same time it was part of internal commerce (Hos. 12:2; Ross 1962: 593; Nowack 1909: 596; Epstein 1993: 133; Frankel 1997: 182).

The Olive Tree in Historical Sources

Historical sources indicate that olive trees and their oil were known from early times in different parts of the world. The Sumerian texts in south Mesopotamia and the Egyptian records mentioned olive oil as an exotic luxury (Frankel 1997: 181). The Ugaritic tablets, of the Late Bronze Age, mentioned the purchase of olive groves and taxes paid in olive oil. The Syrian documents of Alalakh and the Hittite archives mentioned olive oil and its uses. The Assyrian documents of Assurnasirpal and Sennacherib described gardens with foreign plants, including olive (Frankel 1997: 181). Again, Sennacherib described how he anointed the heads of his banquet guests with olive oil mixed with spices. The import of oil from Retenu, Dhaji and Naharina (expected areas of Syro-Palestine) was referred to in other documents. The documents say that soldiers of Thutmosis III being in Dhaji were "drunk and anointed with oil as it was at feasts in Egypt", and his booty lists included two kinds of oil, the sweet and the virgin (green) (Pritchard 1969: 234-239). The tale of Sinuhe, from the Middle Kingdom of Egypt, described the land of Yaa, probably in Syro-Palestine as "had more wine than water, abundant was its honey, plen-

tiful its oil" (Pritchard 1969: 18-19). Biblical sources mentioned the export of olive oil to Egypt. Prophet Hosea mentioned that "...and oil is carried into Egypt" (Hos. 12:1; Frankel 1997: 182; Eitam 1979: 154). Columella, the Roman agronomist and the author of an agricultural manual in Latin, called the olive tree "queen of all trees" (Frankel 1997: 182; Forbes 1978: 37). In conclusion, many researchers believe that the wild olive tree was always native to the Mediterranean region, including Syro-Palestine, and it was the ancestor of cultivated species (Zohary 1962: 287).

Archaeological Evidence for the Olive

Archaeological evidence indicate that olive was one of the earliest cultivated fruits in the eastern Mediterranean basin (Epstein 1993: 133; Zohary 1975: 319). Olive stones have been found at some Natufian and Pre-Pottery Neolithic B sites in Palestine and Cyprus (Frankel 1997: 179), and larger quantities of olive pits were found at a number of Chalcolithic sites in the Jordan Valley, such as Tulaylāt al-Ghassūl, Pella/ Ṭabaqat Faḥl, Tall ash-Shūna North, Tel Tsaf and in the Golan Heights (Zohary 1975; Gophna and Sadeh 1988: 33; Dollfus and Kafafi 1990: 7; Epstein 1979: 22, Fig. 1; 1993: 133). However, it was not firmly established whether the plant had been cultivated during the Chalcolithic. It is suggested that the olive tree may not have been cultivated before the Early Bronze Age (Epstein 1903: 133, note 1; Frankel 1997: 179) but, depending on quantitative data gained from Tulaylāt al-Ghassūl, it is likely that the olive tree was cultivated in that area in the Chalcolithic period (4500-3200 BC). The large number of olive stones collected at that site is considered as archaeological proof in favor of this hypothesis, and the possibility of independent domestication of the olive tree is suggested by some scholars (Frankel 1997: 179-180). On the other hand, Forbes (1978: 37) says that olive existed in the wild in the Aegean region before the end of the Ice Age.

The History of Oil Production

- 1- Archaeological evidence — such as olive remains, basalt equipment and tools — indicate that olive oil extraction was already practiced domestically in the Chalcolithic period (for the evidence from the Golan Heights see Epstein 1993: 133-137, Figs. 3-7). Olive oil production developed in the third millennium BC.
- 2- In the Iron Age, olive oil production became a highly developed industry, and olive oil became a significant trading commodity. The highly improved olive press traditions continued for several centuries, through the Roman and Byzantine periods and even up to modern times. Since the development of technology was rarely immediate, new inventions did not always completely replace older ones (Forbes 1978: 39). It was common

in antiquity to have different types of press operating at the same time in any given area (Epstein 1993: 133-134; Hestrin and Yeivin 1977: 29; Gutman and Wagner 1986: 38, Fig. 18; Kelm and Mazar 1987: 122, Fig. 1).

The Technology of Olive Oil Production

The ancient food production technology encompassed a number of different processes, including grinding, pounding, crushing, pressing, fermenting, salting, drying, smoking, cooking, storing, and transporting. Evidence for most processes can be found in archaeological excavations. I will restrict my discussion here to only two processes, the crushing and pressing of olives to extract oil.

- 1- To produce oil from olives requires, among other things, a crushing basin (mill, mortarium) (see FIG. 6) and a press. The entire olive should be crushed before the resultant paste was pressed (Epstein 1993: 134).
- 2- The production of oil went through three serial stages or processes: crushing the olives to a pulp, then pressing to extract the liquid that flowed into collecting vats located at a lower level. To separate the pure oil, the liquid was left for sedimentation in the vat for a while. When the oil floated on the lee, it was skimmed (Frankel 1997: 180; Forbes 1978: 37). At some Greek sites, the juice was collected in a big tank, then the water was drawn off through a stoppered hole at the base (Forbes 1978: 39).
- 3- The finest oil for use in lighting in antiquity was that dripped from frails (baskets) of crushed olive pulp without pressing. The frails were then gently shaken so as to get that kind of oil (Ross 1962: 592; Hestrin and Yeivin 1977: 29).
- 4- In general, the quality of oil depended on three main factors: the ripeness of the olives, their quality, and the process of extraction. Virgin green and bitter oil came from green unripe olive (Frankel 1997: 180).
- 5- Pottery containers of oil were then sealed (Arad Inscriptions) (Frankel 1997: 182).

Development of Technology

- 1- In the beginning, olives were crushed in mortars often cut into bed rock or contained stone elements likely to leave archaeological remains. A first specific Early Bronze Age oil press was found at Rās Shamra in Syria. It was very simple, consisting of stone slabs on which olives were crushed and pressed by putting stone slabs on woven bags. The flowing oil was collected at a lower level in a collecting vat (Frankel 1997: 180).
- 2- At a later stage, the frails (baskets), full with pulp, were piled on top of each other and pressed by means of a beam, one end of which was loosely fixed into a niche in a wall and the other weighted with stones. Oil was collected in vats and stored in jars. Collected in

- the vats, it was left for a while for the purpose of subsiding the sedimentation (Ross 1962: 592).
- 3- Evidence from Crete, Cyprus and Syria (Ugarit) show that the big technical development of introducing the lever-and-weight press (wooden beam anchored to a niche in the wall, and hanging stone weights) first occurred in the Early Bronze Age. Earliest examples of this type in Palestine were dated to the Iron II. In this latter period, in the north, olives were crushed in round mortars and the weights were unworked field stones. In the south, the technique was more developed: olives were crushed with rollers in rectangular basins, and weights were perforated horizontally or at top to help hanging them from the lever beam (Frankel 1997: 180).
 - 4- The earliest specific and clear vat separators, made of thick pottery in the form of tubs with spouts at the base, were found at Myrtos in Crete. They were recognized as evidence for the earliest oil production, and dated to the Early Bronze Age (around 2200 BC) (Forbes 1978: 46). After draining the water that resided under the floating oil, it was tapped off into a jar.
 - 5- The round crushing basin (mortarium) with rotating millstone was the next development. The beginning of its appearance in our area was in the Hellenistic period, without determining its first date of invention and place of origin (Frankel 1997: 180).
 - 6- A later development of technology was the introduction of the lever-and-screw press (FIG. 1), where the lever was anchored into two slotted monumental piers of stone. It was already widespread in the first century AD (Frankel 1997: 180-181; Forbes 1978: 42).
 - 7- Another development was the appearance of the direct-screw press with two grooved piers to be used together with the lever-and-screw press (FIGS. 2, 3) (Frankel 1997: 181).
 - 8- Archaeological evidence indicated that the heating of olives or probably washing or soaking them in hot water was practiced in the process of production in Palestine (Frankel 1997: 182). It was normal at presses in Greece to pour hot water on sacked pulp and press it another time after being pressed cold in the beginning so as to extract more oil (Forbes 1978: 39). It is probable that pouring hot water was practiced at the 'Abdūn press discussed below. Channeling and piping plenty of water from outside of the complex to its interior indicate that they consumed much water for the purpose of washing the olives, among other uses. On the other hand, traces of burning were detected in the room described by the excavator as being a kitchen. A small limestone basin was found *in situ* at the entrance of the so-called kitchen. The basin, having been filled with hot water, could have been used to soak the pressed sacked pulp before it was pressed another

time. The floating oil in the basin was then skimmed off.

- 9- Olive wastes from oil production consisted of the pomace water, solids and pits. The solid waste (Arabic *jift*) was used for animal fodder and fuel for heating.

The Distribution of Olive Presses in Jordan

The total number of olive presses, from different periods, registered in JADIS (Jordan Antiquities Database and Information System) is thirty one. Most are just mentioned during archaeological projects, without paying much attention to them in terms of study. Due to the lack of information, we can safely say that the real number of presses exceeds the archived amount.

Of the recorded presses, two are dated as "Roman": one at as-Salt and the other at Khirbat al-'Ajam. Three other presses have been dated to the Byzantine period: one at Khirbat adh-Dhariḥ, one at Zay, and the third is located at the 'Ammān Citadel. Six other presses have been referred to as "Islamic": one is located at Khirbat an-Nawāfla/ Wādī Mūsā, another at Jil'ād, and a third at Qaṣr as-Sil, in the fringes of the desert. The three others started during the Byzantine period and continued during the Umayyad, including the one at the 'Ammān Citadel (Zayadine 1979: 20-28). Another Islamic press was excavated at Rujm al-Kursī, in western 'Ammān.

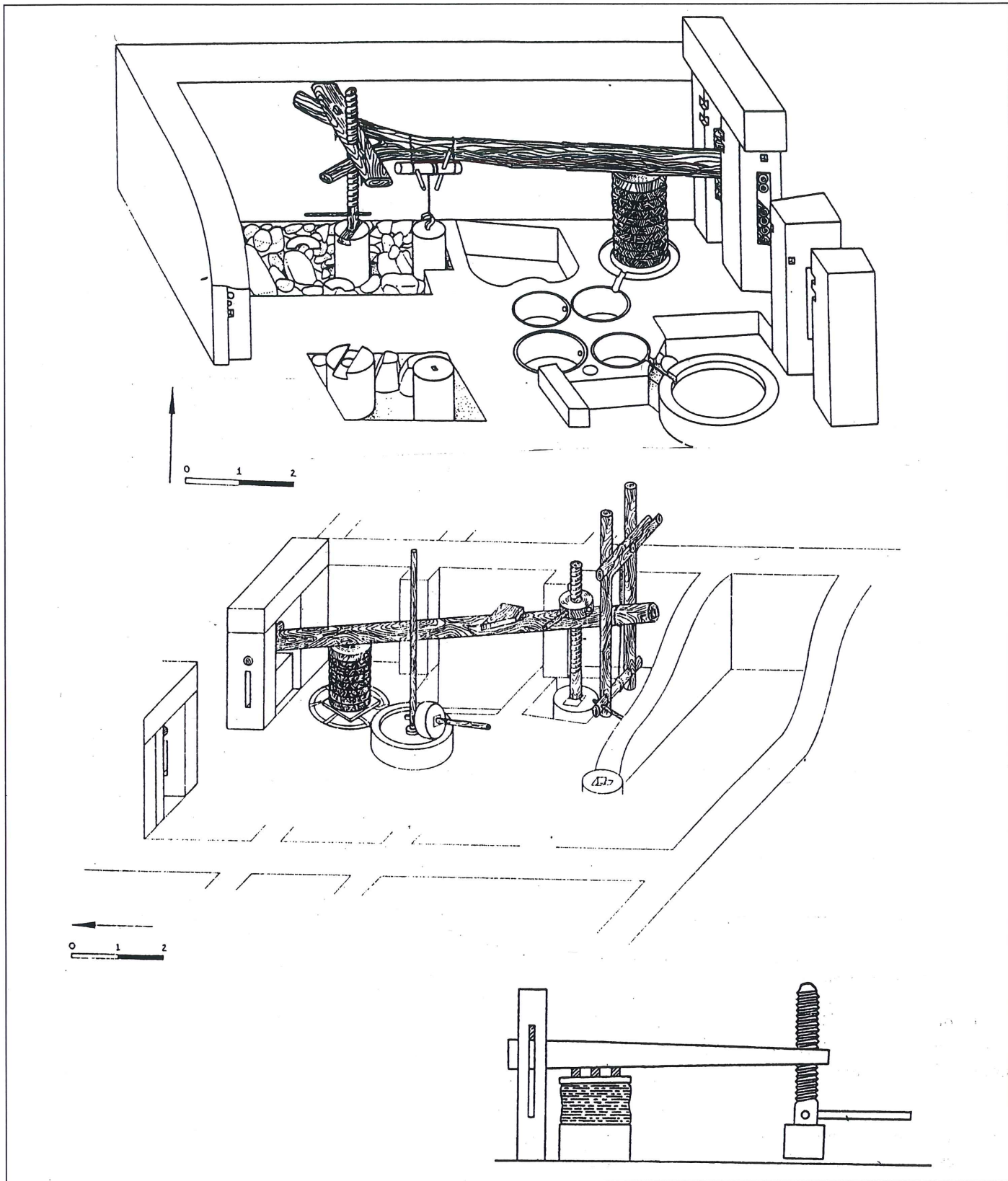
The 'Abdūn Press Installation in 'Ammān

Due to urban zoning requirements, two long seasons of salvage excavation (three months each) were implemented through the program of Cultural Resources Management of the Department of Antiquities of Jordan on a parcel of land of private property. The excavation was directed by Yazeed 'Ulayan, without whose cooperation this article could not be compiled.

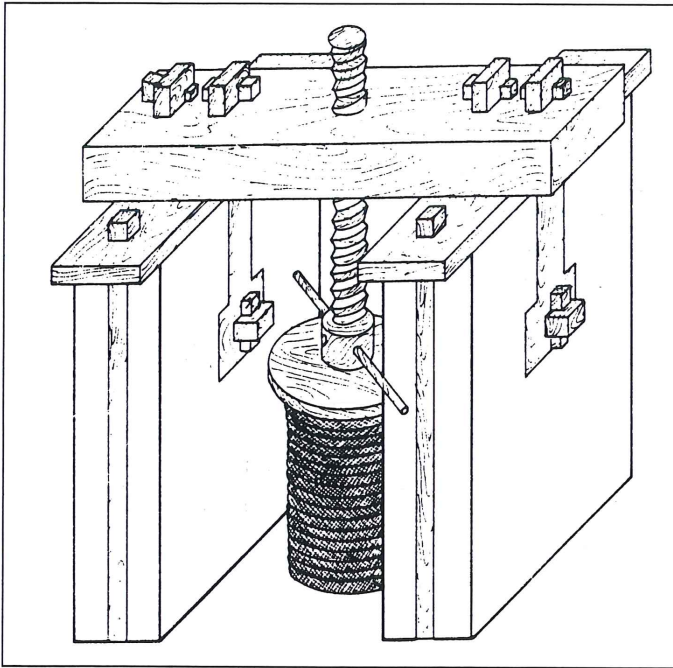
The excavation was carried out in 1995-96, on a raised spur 200m south of an ancient settlement, recently named the "Village of 'Abdūn". In antiquity, the site overlooked a wide range of uneven fertile agricultural fields suitable for dry farming in all directions. Unfortunately, large portions of these fields are now covered with modern villas and high-rise buildings.

Large portions of the site were bulldozed and illicitly excavated by treasure hunters two or three decades ago, which caused the destruction of long extensions and many details of the site.

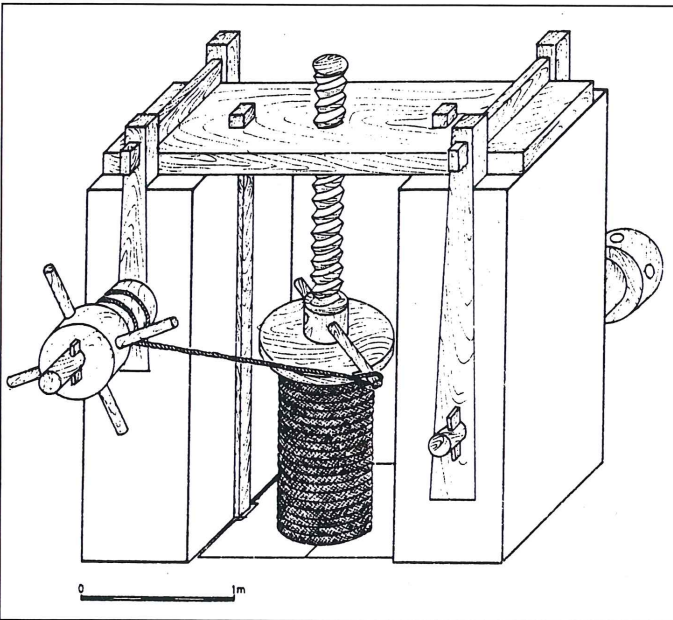
The excavations resulted in the discovery of part of an industrial workshop dedicated to the treatment and production of olive oil and probably wine (Ulayan 1996, comprehensive details are included in this unpublished report). The evidence indicates that the complex had an upper floor, the *in situ* remains of which consisted of a fragment of a mosaic pavement surmounting a joint of walls of the ground floor. The excavated remains meas-



1. Development of the lever-and-screw presses (after Frankel).



2. A south Palestinian direct-screw-drive press (after Frankel).



3. Bayt Şafāfa/ Safsafot direct-screw press (after Frankel).

ured 60m east-west and 50m north-south. The complex was built of rough field stones, but some details such as arches, lintels, thresholds and door frames were constructed with trimmed limestone (FIG. 4). It incorporated a series of inter-linked rooms, roofed with the aid of arches, and paved mainly with white mosaics of relatively large tesserae. Floors of the different rooms were not at the same level, some rooms were intended to be higher than others so as to meet the needs of the industrial pur-



4. 'Abdūn: The eastern entrance of the complex with a cross on the lintel.

poses and the requirement of gravitational flow of fluids.

Two small Byzantine chapels, not contemporary, were annexed to the complex on one alignment to its north-west.

At the extreme southwestern side of the complex, scanty structural remains restricted to two mosaic floored rooms were said, by the excavator, to be a wine press. One room included the remains of four relatively small basins, one of them with an outlet hole at the base. The other room included a two meter deep cistern or basin with mosaic floor. It had a pottery outlet pipe connected at the top with another cistern located in the first room. Two high fragments of mosaic floors of unclear function were possibly connected with these rooms.

A covered channel used to fetch fresh water to a ten meter deep cistern was located under the main corridor (FIG. 5). Another two meter deep cistern was placed seven meters northwest of the first one. Before it reached its destination, the channel ran under the floors of different rooms, and before that it ran exposed along the wall of the first room it entered from exterior.



5. 'Abdūn: Detail of the water channel inside the main corridor.

The most clear elements worthy of study within the complex are the components of an olive press. These components mainly occupied a hall measuring 7.6 x 4.6m. The hall was accessed from the main corridor by descending four steps. Another door led towards the west where mixed debris was left unexcavated. A third doorway led eastwards, into the storage room, in which broken pottery storage jars were crushed *in situ*.

Description of the Press

A 70cm high crushing circular basin (mortarium, FIG. 6), of 1.9m diameter, was found next to a direct-screw press (FIG. 7a, b). The mortarium has a flat crushing depression with a central protrusion, and was made from one big block of hard limestone. Due to heavy and long use, the outer rim (lip) was eroded and mended twice. The first mending was done by building blocks of limestone around the remnant of the mother block to create a new rim. The second mending operation was needed to fill a gaping line created by time between the mother block and the constructed rim of the basin.

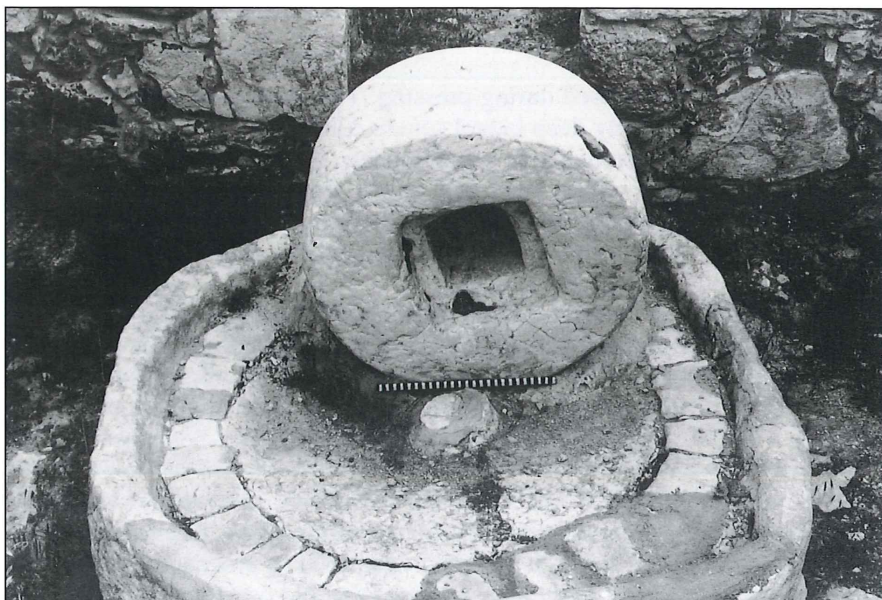
A circular thick millstone made of very hard limestone was found still standing inside the crushing basin cavity (orb). Its diameter is 91cm and its thickness is 45cm. This kind of crushers, in 'Abdūn, had several advantages that could compensate for the less efficient twin-stone crushers. It was cheaper to manufacture because there was no need to carve out the basin to fit the curve of the twin stones, a procedure that was widespread in Greece and Palestine whereby it was easier to remove crushed pulp from the basin (Forbes 1978: 42).

Being installed in a narrow space in a crowded room, the crushing millstone of the 'Abdūn press was rotated by

human power, as was the case in other presses installed in a similar environment (Hestrin and Yeivin 1977: 29-31).

To the southwest of the basin, the above-mentioned direct-screw press was revealed (FIGS. 7, 8). It consisted of two heavy tall rectangular stone piers, both grooved from the anterior and posterior, erected apart, one on either side of a semi square pressing bed. The left pier had another long groove on the exterior of its lateral face. The function of those long grooves was a matter of argument. Dalman pointed out that the grooves served to guide the pressing board. Frankel, who denied this function depending on excavated evidence, pointed out that they were to hold rods that were secured in the rock below the piers and in similar holes in the thread board above the piers, thus stabilizing the press as a whole and acting to withstand lateral pressure during pressing. In the case of the 'Abdūn press, the hypothesis of Frankel seems more sensible. Another groove was added to the exterior of the lateral face of the left pier with no apparent function other than that proposed by Frankel (Dalman 1964: 226-227, Pls. 69-70; Frankel 1988: 82).

Each pier had one short groove that ran from the top down, and after around 40cm, it ended with a mortise on the interior and exterior of the lateral faces. The mortises were horizontally drilled, they and their bore-holes secured, together, the fixing on top of the piers, which was a thick wooden board with a female thread in the center. A wooden screw was turned in that thread. The free low end of the screw pressed on a pressing cylindrical screw weight with flange and closed central dovetail rectangular mortise. The weight in turn pressed the piled frails (baskets) full with olive pulp. Parallels could be sought in Palestine (Frankel 1988: 81, Fig. 5; 1992: 57).



6. 'Abdūn: The crushing basin with central protrusion and millstone.

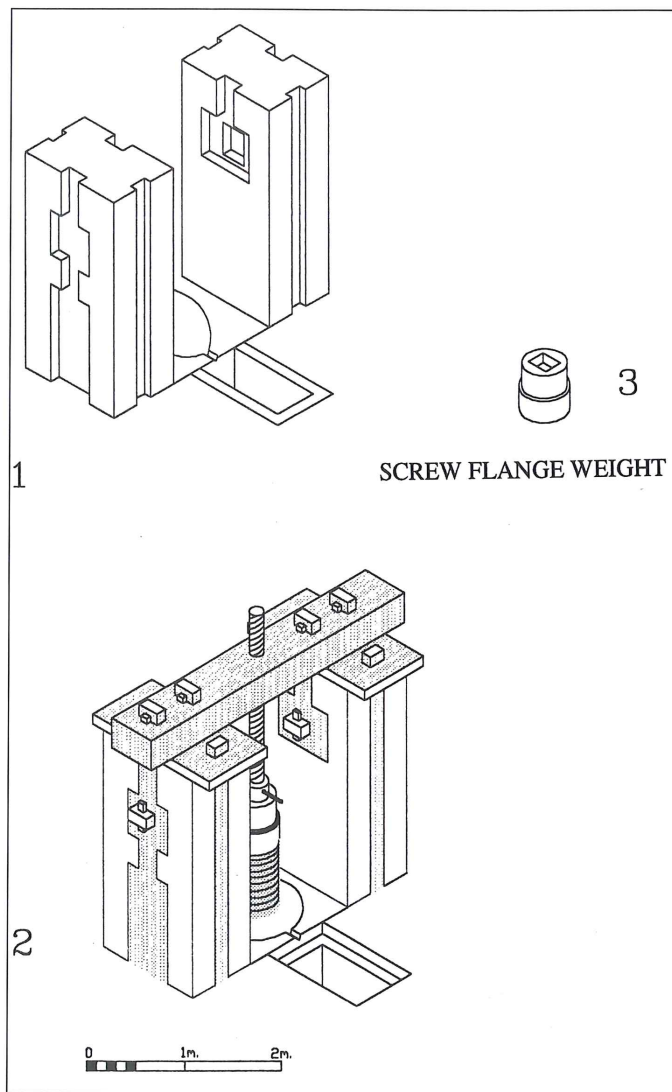


7a. 'Abdūn: Two grooved piers with mortises and pressing bed.



7b. Right pier with unlevelled two notches to hold the weight rod.

Between the two piers there was a semi square press bed with a circular groove close to the square perimeter, to force the extracted oil flow into the lateral vat. The frails of olive pulp were put on top of each other on the



8. 'Abdūn direct-screw press.

press bed during pressing. The oil flowed aside into a relatively deep lateral square collecting vat with stepped rim, presumably to accommodate a lid (FIG. 9). A short sloping outlet hole just below the rim led to the vat. The pressing bed and the vat were cut into the bedrock. The vat measures 60 x 60cm and 1m deep. The vat lid was robbed in antiquity.

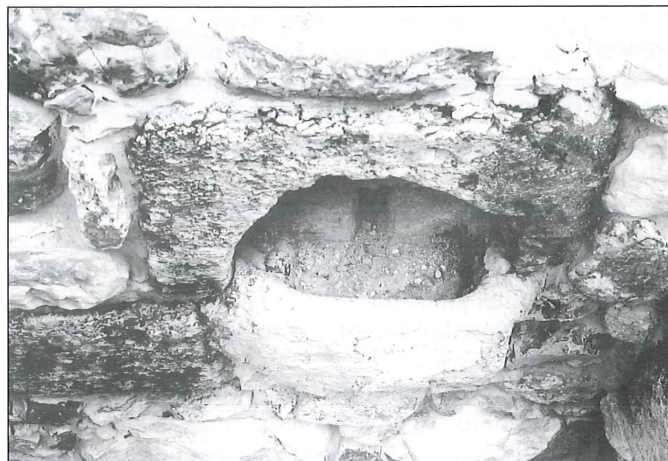
A semi domed niche exists at a height of 1.30m in the eastern wall of the press hall, behind the left pier (FIG. 10). The location of the niche is in alignment with the pressing bed of the screw-press. This situation leads us to think of the existence of an older lever-beam press at the location. A beam was probably anchored in the niche and the free end extended westwards towards the same existing pressing bed of the screw press. Even the existing vat would have been used in that procedure. The screw press might have replaced that old one for some reason.



9. 'Abdūn: The pressing bed with the screw-press weight fallen inside the stepped vat.

Comparative Study

- 1- In 'Abdūn, the archaeological evidence showed that a beam was already anchored in a niche (FIG. 10) in the wall and the oil collected in a lateral vat. This is a common older system in the region, noted since the Iron Age and other later periods. Parallels were found at sites throughout Palestine (Frankel 1992: 62; Eitam 1979; Gutman and Wagner 1986; Magen 1984).
- 2- At a later time, a modification occurred. Two parallel heavy stone piers, perforated and mortised on top, were erected at a distance of 70cm from the eastern wall that embraced the niche, one on either side of the semi square pressing bed. The beam was substituted here by a vertical screw, the fixed end of, which used to be anchored in a thick board (thread board) surmounting the two piers. The extracted oil continued to be collected in a lateral vat. This system differs from the Phoenician lever-and-screw system, but on the other hand, in function and form, it looks similar to some



10. 'Abdūn: The wall niche of the old lever-beam press.

direct-pressure-screw presses of grooved and mortised piers discovered in South Palestine (Frankel 1988: 77-91, Figs. 2-5; 1992: 46, 65). Slotted perforated piers were in use in presses in the region, and it was proposed to call them the "Phoenician type" since their distribution was more attested towards Phoenicia, and even though parallel examples of piers were attested in Tunisia and Libya, these mainly had several perforations on each pier in contrast to the Phoenician and Galilee examples (Frankel 1992: 63).

In the case of the 'Abdūn piers, rather than being slotted, they had only one perforation on top, a system that could not allow for free adjustment of the height of the beam. This type of perforation was less attested in the region than the slotted even though a few examples were converted from the use of slotted to perforated piers (Frankel 1988: 77-91; 1992: 65).

The 'Abdūn press was of the direct-screw-weight type. Classical literature indicated that the screw element was in use in oil presses by the first century AD (Vitruvius 1931: 34, 6:6:3; Frankel 1992: 66). On the other hand, archaeological evidence showed that the direct-screw press, specifically in Galilee in the north, was known in the second and third centuries AD. It seems that this type of press was more familiar in the north and was of northern rather than southern development of technology (Frankel 1992: 66). However, direct-screw presses with grooved piers were more attested in South Palestine (Frankel 1988: 82, Fig. 6, Table 2) and was also known in Phoenicia, with several examples at (Frankel 1988: 82-83).

Parallels to the 'Abdūn Press

A study carried by Frankel in Palestine tends to relate the direct-screw-weight with grooved piers to the south, as a direct development from the southern lever-and-weight type (Frankel 1988: 77-91) (FIGS. 2, 3). For the purpose of comparison, one can say that the type of the

'Abdūn press, with one perforation on top of the two grooved piers, could be sought between the direct-screw press with grooved piers discovered at Bayt Šafāfa/ Safsafot in the Galilee of Palestine, and the grooved type of South Palestine ("Judean type" as it was called by Frankel 1988: 77-91, Figs. 2-5). The common similarities among the three examples support the idea that they all were derived from a common prototype:

- 1- The 'Abdūn press and the other two examples consist of two parallel piers, one either side of a pressing bed.
- 2- The three examples functioned in the same way, as direct-screw presses.
- 3- The 'Abdūn press, with the two piers being vertically grooved from top to bottom on the anterior and posterior faces, looks like the South Palestinian press and differs from the "Safsafot type" that was totally grooved on the inner face and partially grooved on the anterior and posterior faces to support the dovetail mortises.
- 4- The 'Abdūn press has one direct square perforation on top of the lateral face of each pier with mortises, similar to the South Palestinian presses. The "Safsafot press" is different in this element since its lateral faces were not perforated (Frankel 1988: 83, Figs. 2-5). The flanged screw-weight had parallels in Palestine (Frankel 1992: 46-47).

On the other hand, there are several elements of difference:

- 1- The 'Abdūn press had the left pier grooved all the way down on the exterior lateral face in addition to its mortise on that direction. The right pier had its exterior and interior faces void of any grooving. In this element it is different from both the Safsafot and the South Palestinian examples.
- 2- The collecting vat of the 'Abdūn press is lateral while that of the other two examples is between the two piers (Frankel 1988: 82). The lateral vat was a usual universal system applied throughout the Mediterranean area in antiquity and in recent times, with a few ancient exceptions for using central vats (Frankel 1992: 65-66).
- 3- The dovetail-mortise of the screw-weight of the Safsafot type is linked more to Phoenicia than anywhere else, since it was more attested in the north. Other evidence links such dovetail-mortise to an older origin attested on Phoenician ivories of the Iron Age period (Frankel 1992: 66; Barnett 1982: 13). In the Safsafot press, this kind of mortises appeared intentionally with grooves on anterior and posterior faces at a non-identical level on both piers. The shorter to hold the drum that served to turn, with a rope, the handspikes of the screw in the beginning of each meal of pressing when the pile of baskets was still high. The lower mortise when the pile went low (Frankel 1988: 88). Many variants of the "Safsafot model" were discovered in the Galilee, with differences concerning the location of the

dovetail mortises and the existence and nonexistence of fixing bores. This technology did not appear on the 'Abdūn press or on the South Palestinian presses. Noticing these variations in the north, Frankel came to the conclusion that the South Palestinian was the prototype of the direct-screw-weight press of grooved type (Frankel 1988: 88-89).

- 4- The 'Abdūn press had one millstone, standing *in situ*, to rotate in the crushing basin with a central protrusion without a socket, contrary to a few cases discovered in Palestine, especially in Galilee, where two convex millstones rotated in a basin with a protrusion but without a socket, joined by a horizontal shaft that served both as axle and handle. On the other hand the use of one millstone was familiar in the region (Frankel 1992: 59-62).
- 5- It seems that the modified direct-screw 'Abdūn press did not have any pulleys or ropes to lift pressing weights, as it was the case in different examples in Palestine (Frankel 1992: 46).
- 6- The press bed in 'Abdūn had a semi circular groove rather than a lifted rim. Both systems were attested in many cases in Palestine (Frankel 1992: 39-68).

Dating

It is proclaimed that the direct-screw-weight presses of grooved piers were already in use in the Roman period. Some examples discovered in South Palestine have been dated to the Byzantine period (Khirbat al-Qaṣr 32, Khirbat al-Qunayṭira 34), while others were dated to the early Islamic period (Khirbat Dūqās) (Frankel 1988: 82).

Excavations at 'Abdūn revealed a hoard of 73 gold coins of the Byzantine period. They covered the period extending from AD 491 to 610. Byzantine pottery, storage jars and other vessels of the same period have been excavated. Additionally, two early Umayyad bronze coins were found, one at the floor of the main corridor, the other on the floor of a chapel, as well as "transitional" and early Umayyad pottery.

According to the given evidence, one can confidently say that the workshop began and functioned in the Byzantine period, somewhere around the end of the fifth century AD, and continued in existence into the beginning of the Umayyad period.

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